# THE JOURNAL OF ENGINEERING EDUCATION

VOLUME 34 NUMBER 4

## *Contents for December, 1943*

AN EDITORIAL. *Allen R. Cullimore, Vice President* ..... 299
MORALE AMONG A.S.T.P. TRAINEES. *Robert E. Doherty, President* .... 300
TO MEMBERS OF S.P.E.E. ..... 301
MINUTES OF COUNCIL MEETING, OCTOBER 25, 1943 ..... 303
ADMINISTRATIVE DIVISION, S.P.E.E.:
PROGRESS REPORT OF S.P.E.E. COMMITTEE ON A.S.T.P. AND N.C.T.P. *Robert E. Doherty* ..... 306
INFORMAL DISCUSSION OF CURRENT A.S.T.P. DEVELOPMENTS:
*Lt. Col. T. D. Palmer* ..... 310
*Lt. Col. F. H. Pumphrey* ..... 316
INFORMAL DISCUSSION OF CURRENT N.C.T.P. DEVELOPMENTS. *Jos. W. Barker* ..... 318
GENERAL DISCUSSION ..... 319
TRAINING THE ORDNANCE SOLDIER. *Brig. Gen. H. R. Kutz* ..... 326
WHAT INDUSTRY EXPECTS OF ENGINEERING EDUCATION AFTER THE WAR. *Alex. D. Bailey* ..... 335
PRE-WAR ENGINEERING SCHOOLS IN A POST-WAR WORLD. *E. S. Burdell* ..... 340
SEMINAR IN ENGINEERING EDUCATION ..... 348
NEW MEMBERS ..... 356
THE 1944 MEETING ..... 357
COLLEGE NOTES ..... 357
NECROLOGY: JOHN LANE VAN ORNUM ..... 358

*Published monthly (except during July and August) at Prince and Lemon Sts., Lancaster, Pa., by the Society for the Promotion of Engineering Education under the Supervision of the Publication Committee: H. T. Heald, Robert E. Doherty, F. L. Bishop, Editor, University of Pittsburgh. Entered as second class matter, October 17, 1912, at the Post Office at Lancaster, Pa., under the Act of August 12, 1912. Subscription Price, $3.00 per year; Single Copies, 50 cents.*

# THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

## OFFICERS 1943–44

**President**

ROBERT E. DOHERTY, Carnegie Institute of Technology, Pittsburgh 13, Pa.

**First Vice President**

A. R. CULLIMORE, Newark College of Engineering, Newark, N. J.

**Second Vice President**

H. J. GILKEY, Iowa State College, Ames, Iowa

**Secretary**

F. L. BISHOP, University of Pittsburgh, Pittsburgh 13, Pa.

**Treasurer**

J. S. THOMPSON, McGraw-Hill Book Co., New York City

**Assistant Secretary**

NELL MCKENRY, University of Pittsburgh, Pittsburgh 13, Pa.

**Headquarters**

University of Pittsburgh, Pittsburgh 13, Pa.

**52nd Annual Meeting**

Cincinnati, Ohio

June 22–25, 1944

**Host**

University of Cincinnati

## COUNCIL

### I. Elective Members

*Terms Expire in 1944*

J. H. Belknap
A. C. Callen
F. M. Dawson
N. W. Dougherty
Selbert Fairman
C. J. Freund
R. P. Hoelscher

*Terms Expire in 1945*

H. L. Dodge
J. C. Elgin
L. J. Fletcher
C. E. Lawall
R. L. Spencer
C. E. Tucker
Jos. Weil

*Terms Expire in 1946*

E. L. Eriksen
W. O. Hotchkiss
Thorndike Saville
R. H. Spahr
G. L. Sullivan
F. L. Wilkinson
W. R. Woolrich

### II. Past Presidents—Members Ex-Officio

C. Frank Allen
D. C. Jackson
F. E. Turneaure
Anson Marston
Henry S. Jacoby
Arthur M. Greene
Mortimer E. Cooley
Chas. F. Scott
A. A. Potter
G. B. Pegram
O. M. Leland
R. L. Sackett
D. S. Kimball
H. S. Boardman
H. S. Evans
R. A. Seaton
W. E. Wickenden
C. C. Williams
D. S. Anderson
H. P. Hammond
S. B. Earle
K. T. Compton
O. J. Ferguson
D. B. Prentice
A. H. White
H. T. Heald

# An Editorial

By ALLEN R. CULLIMORE
*First Vice President of the Society*

Of particular significance to every teacher and administrator in our engineering colleges is the question of proper selection of students for the engineering profession. The quality of the material not only affects the finished product but the machinery and the processes we employ in engineering education. The Society has always been interested keenly in this problem and for two years, in conjunction with the Engineers' Council for Professional Development, has been giving it special study under the direction of R. S. Bartlett.

This study was necessarily limited by the funds available but enough was done to indicate the possibilities and to assure the sponsoring bodies that the work should be, if possible, undertaken on a much larger scale.

Through the efforts of Dean R. L. Sackett and our President, Dr. Doherty, the Carnegie Foundation for the Advancement of Teaching was interested in the project, and out of this interest grew a proposal that the Foundation under the sponsorship of the S.P.E.E. and the E.C.P.D. should undertake a project in the field of measurement and selection of students. The study proposes to test students at entrance and at the end of each academic year so that promise may be substantiated in terms of accomplishment. It is hoped that the project will not only result in helping us select students but will assist greatly in subsequent orientation and guidance.

The project is largely financed by the Carnegie Foundation and is guided by an advisory committee composed of representatives of the two sponsoring societies and the Foundation. The executive and professional work of testing is under the jurisdiction of Kenneth W. Vaughn of the Foundation. Offices have been secured and a staff assembled at 437 West 59th Street, New York City.

Eleven institutions have been selected in which the first exploratory tests are to be given. Tests have been given in five of these institutions and other tests are being given as fast as new classes enter.

From time to time articles will appear in the JOURNAL indicating the progress of the study. I submit that you should follow this project closely. It can only be successful through coöperation, and necessary to this coöperation is a thorough understanding of the objectives, values and procedures.

We all will, I think, be highly gratified that this important phase of our work is in the hands of an organization such as the Carnegie Foundation. Those of us who are following this work closely have high hopes for its success.

# Morale Among A.S.T.P. Trainees

By ROBERT E. DOHERTY
*President of the Society*

In the September issue of the JOURNAL I reported the establishment of the S.P.E.E. Committee on A.S.T.P. and N.C.T.P., and on other pages of this current issue you will find a complete report of Committee activities up to September 30, 1943. Things are moving fast, and there is a new matter which I wish now to bring to your attention.

It relates to the morale of A.S.T.P. trainees. Reports have come to A.S.T. Division from a few campuses that some of the students have become restive, and Colonel Herman Beukema and his staff have expressed the hope that engineering faculties and administrative officers might do whatever they can toward helping the trainees to attain a better understanding of their own situation and thus a better frame of mind.

There appear to be two sources from which bad morale may develop. The first is the effect of unavoidable changes in Army demands for specialized personnel as the tides of war continually shift. One unexpected, but certainly most welcome, change was the reduced demand for officers which brought a marked reduction in openings for Officer Candidate Schools. I say "most welcome" because I am told that at the bottom of this change was the fact that losses in personnel in the African campaign were unexpectedly very light. Again, more recently heavy demands for certain specialized personnel have required that a large number of Term III trainees be taken for immediate service. It may be a fair criticism that, since changes of this character were to be expected in war, the earlier statements of A.S.T.D. might have been more carefully worded so that undue hopes might not have been raised. In any case, however, the situation we are dealing with is the present one, and our purpose should be to do all we can to make that situation now what it ought to be. Hence the A.S.T.D. hopes that we may feel responsibility for cultivating good morale, and that in response to the troublesome question that the trainees ask—"What am I going to do when I leave A.S.T.P.?"—we may help them understand that shifts in requirements for specialized and officer personnel are to be expected, that although at the moment the demand for officers is at a low ebb this situation is likely to change, and that in any case the work the trainee is doing is improving his opportunity for advancement if he makes good in whatever assignment he is given later on. The fact that he did successful work in the A.S.T.P. will place him in a preferred position.

The other source of bad morale is, one would hope, not very prevalent, but sufficient reports have been heard about it to warrant my laying it before you. There is evidence that some instructors who themselves are perhaps not fully informed regarding the purposes and policies of A.S.T.P. have made unguarded statements that have apparently tended to increase confusion and lack of confidence on the part of the trainee. I am sure that there are extremely few among us who would deliberately disparage the Program in the eyes of the trainees, and I am sure that, in view of the urgent request of the A.S.T.D. Headquarters, we shall all wish to use the classroom and our other contacts with the trainees for the purpose of helping them to maintain enthusiasm for their work and belief in its genuine importance.

# To Members of S.P.E.E.

President Doherty in his S.P.E.E.–E.C.P.D. letter to Members of S.P.E.E. (Sept. 28, 1943) refers to the present efforts of the Committee on Professional Recognition "to cultivate in the minds of new generations of engineers a professional consciousness and an understanding of what the profession's place in society should be and the individual engineer's responsibility in relation thereto, so that when these generations reached maturity there would be more likemindedness among the individual engineers. Thus could the profession achieve the prerequisite understanding of its new role. It lies in the hands of engineering teachers to bring about this new understanding."

The annual report of the committee (October, 1943) has received this appraisal by a veteran teacher, Professor Hardy Cross:

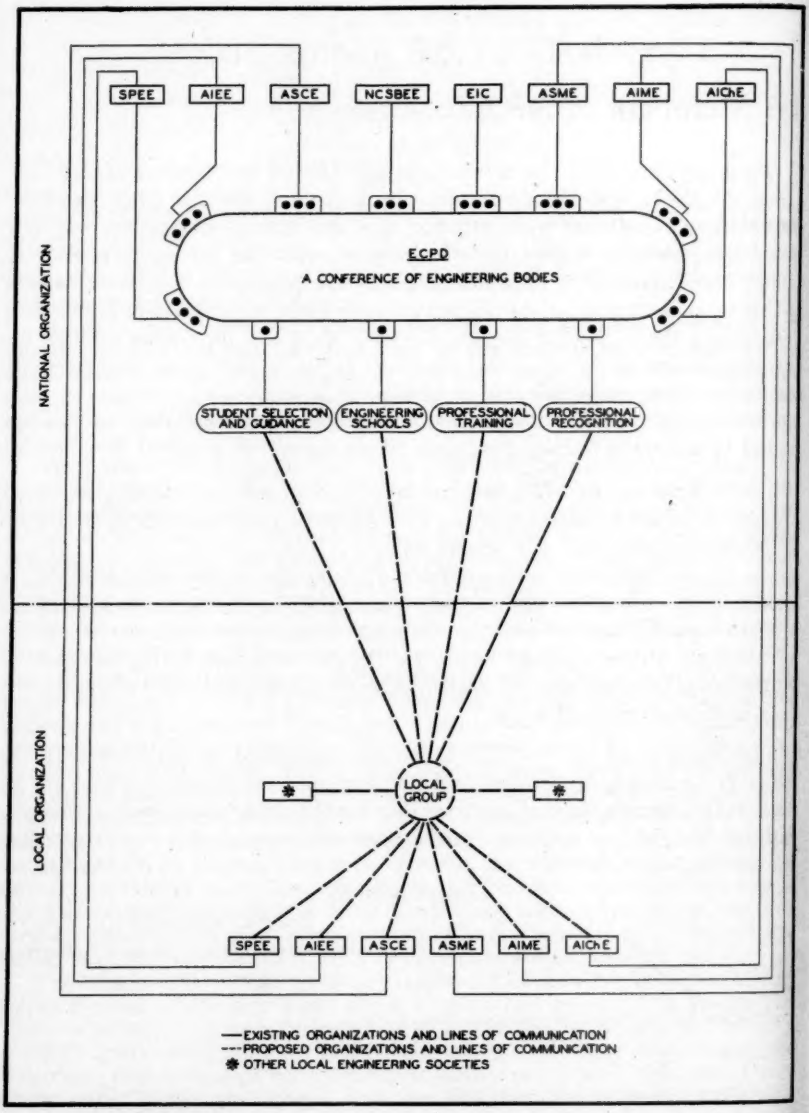
> "I think anyone will find compulsion to thoughtfulness in this report since it raises so many questions such as what is engineering, what is a profession, and what is a second mile.
>
> "I am somewhat intrigued by your reference to the long accepted definition of engineering on page four. I am sufficiently ignorant so that I am not sure where this definition came from. It interests me. Certainly it covers enough territory. Be that as it may, I feel sure that there will be many who will heartily respond to the opportunity which this report promises for service."

As chairman of the S.P.E.E. Committee designated to coöperate with the E.C.P.D. Committee on Professional Recognition, I am enclosing a copy of the *E.C.P.D. Committee report, knowing that it will induce "compulsion to thoughtfulness" and lead to response "to the opportunity which this report promises for service."

Sincerely yours,

IVAN C. CRAWFORD,
*General Chairman, Coördinate Committees in Personnel Development*

* This will be mailed to you from New York.




This is a diagram illustrating the plan described in the November JOURNAL, page 206, according to which the S.P.E.E. may coöperate directly with the Committee of E.C.P.D.—F. L. BISHOP, *Editor*.

# Minutes of Council Meeting, Chicago, October 25, 1943

Present: Robert E. Doherty, A. R. Cullimore, H. J. Gilkey, J. S. Thompson, F. L. Bishop, A. C. Callen, F. M. Dawson, N. W. Dougherty, C. J. Freund, R. P. Hoelscher, H. L. Dodge, L. J. Fletcher, C. E. Lawall, R. L. Spencer, E. L. Eriksen, Thorndike Saville, F. L. Wilkinson, W. R. Woolrich, A. A. Potter, R. A. Seaton, C. C. Williams, H. P. Hammond, S. B. Earle, O. J. Ferguson, D. B. Prentice, A. H. White, H. T. Heald.

Council approved:

(a) The recommendation of the Executive Committee that the traveling expenses of emergency committees be paid whenever it was found necessary to call a meeting of such committees between annual meetings of the Society.

(b) The recommendation of the Executive Committee that beginning with the next fiscal year of the Society the advertising rates in THE JOURNAL OF ENGINEERING EDUCATION be increased.

(c) The plan submitted to the Society by E.C.P.D. for facilitating a two-way flow between E.C.P.D. and local engineering organizations and student branches with S.P.E.E. on the campuses. This plan should provide greater incentive for activities and interest. (See November JOURNAL for plan.)

It was the consensus of Council that delinquent members should not be dropped until December 1 thus giving them another chance to pay their arrearages. The Secretary was instructed to write deans of engineering colleges where members of their staffs were in arrears to ascertain whether or not the men were in service or unable financially to pay dues.

A special committee was appointed to arrange for the purchase by the colleges, after the war, of equipment which might be used by them. The committee is C. E. MacQuigg, *Chairman,* A. R. Carr, D. S. Eppelsheimer, R. D. Goodrich, E. L. Keller, W. E. Wickenden.

A committee was appointed to explore the possibility of establishing improved understanding between colleges and industry and to present a report to the Council. The committee is L. J. Fletcher, *Chairman,* Gibb Gilchrist, C. E. MacQuigg, A. A. Potter, R. H. Spahr, A. R. Stevenson, F. L. Wilkinson, B. M. Woods.

The Program Committee was instructed to arrange for a conference at our 52nd annual meeting in Cincinnati, June 22–25, 1944, in coöperation with the College Committee of the American Society of Agricultural Engineers.

**Consultative Committee.** President Doherty reported that a resolution had now been approved in which it was agreed that any recommendation from the several engineering societies to the Government in connection with the War Manpower would be made through the Consultative Committee appointed by the boards of the societies.

A. A. Potter, H. P. Hammond and Thorndike Saville were appointed a committee to prepare a resolution re returning veterans' program. The following resolution was unanimously adopted:

"The Council of the Society for the Promotion of Engineering Education, in recognition of the fact that instruction in engineering and related sciences will comprise a large and important portion of the postwar education of returning veterans, and that policies governing any national program of higher education for veterans are of great importance, recommend:

"1. That the agency to be charged with the administration of such a program deal directly with the colleges and universities in which such training will be conducted and not through agencies of the several states.

"2. That there be established committees in the several fields of higher education to serve without compensation in an advisory capacity to the administrating Federal agency to the end that these problems peculiar to each such field shall be considered by groups preëminently qualified to present experienced judgment on such matters.

"3. That based on the very satisfactory experience of the engineering colleges conducting war training courses under the auspices of the United States Office of Education, it is felt that the general administrative policies and organization so successfully employed by this Agency should be used as a prototype for administration of Federal participation in postwar education.

"4. That the practice of the United States Office of Education of employing experienced engineering college educators and administrators in key positions on its administrative staff be adopted by any Federal agency charged with administering the program of higher education for returning veterans involving engineering and related sciences."

**Kilgore Bill.** This Bill is full of matters which are of enormous consequence to engineering education and the future of American industry. A. R. Cullimore, *Chairman,* C. E. MacQuigg, A. A. Potter and W. R. Woolrich were appointed a committee to bring in a resolution concerning this Bill.

"The Division of Administrative Officers of the Society for the Promotion of Engineering Education representing the administrators of colleges of engineering in the United States have passed today (October 25, 1943) the following resolution:

"Whereas, four bills known as S.607, S.702, H.R.2100, H.R.2285, are being considered, and

"Whereas, the engineering colleges of the country are very intimately concerned with scientific and technological research in all fields and at all levels, and

"Whereas, we favor some form of Government assistance for the benefit of science and of the industries of this country great or small, and

"Whereas, we have studied the bills above mentioned carefully and find them, in our opinion, dangerous and detrimental to the development of science and technology in war or in peace, therefore be it

"RESOLVED: That we definitely and emphatically oppose the passage of these bills and suggest further study as vital to the framing of proper legislation."

Ivan C. Crawford, Chairman of the S.P.E.E. Coördinating Committees on Personal Development, presented the following report which was accepted:

"Since my report to you of last June regarding the presentation of the professional aspects of engineering, the problem has become more immediate and more pressing. Both the Army and the Navy College Training programs demand every moment of the students' time, except for very brief periods at the weekend. Neither the schedule of the Army nor the Navy permits the orientation periods formerly so prevalent in our engineering curricula. It is also very difficult to schedule meetings of the student branches either at four o'clock in the afternoon or in the evening, because Army students have physical training, drill and laboratories which prevent meetings.

"For the above reasons it seems imperative that some approach be found which will bring to the service students a recognition of the fact that there are professional aspects to engineering. Charles F. Scott, Chairman of the E.C.P.D.'s Committee on Professional Recognition, and I have worked out the following program which we hope will in some measure overcome the present difficulties. If these difficulties are overcome, we feel that it can only be done through a recognition by individual teachers of the importance of the problem, and therefore our suggested solution emphasizes the point by taking the following steps:

"1. We have asked President Doherty to write a letter to each member of the Society in which the key position of the engineering teacher is emphasized in bringing to the student the consciousness of the meaning of professional development.

"2. We have planned to invite prominent engineers to contribute to a symposium on the subject and will endeavor to have these contributions printed at intervals in THE JOURNAL OF ENGINEERING EDUCATION and other engineering publications.

"3. Dr. Scott and I will address a letter to the counsellors of the chapters of the student societies and send with this letter the report for the year of the E.C.P.D.'s Committee on Professional Recognition.

"We are thoroughly convinced that Dean Agg of Iowa State College went to the heart of the whole matter when he stated: 'We believe that the most effective method of instilling the truly professional attitude in the minds of engineering students is through the influence of the individual members of the staff.' For this reason, we are directing our effort in the present emergency to the individual teacher."

The Secretary reported that the printer had found it necessary to increase the cost of printing THE JOURNAL OF ENGINEERING EDUCATION.

Thirty-eight individual members and the University of Nevada were elected to membership in the Society.

Respectfully submitted,

F. L. BISHOP, *Secretary*

# Progress Report of S.P.E.E. Committee on A.S.T.P. and N.C.T.P.*

By ROBERT E. DOHERTY, *Chairman*

I wish to report upon progress since the Committee's Pittsburgh meeting on July 18th. I might say, incidentally, that some items to which I shall refer involve the Chairman's positions as E.C.P.D. Chairman and also member of the A.S.T.P. general Advisory Committee. But the opportunity for whatever help the A.S.T.P. may have received through E.C.P.D. channels, and much of my part in the general Advisory Committee, were largely afforded by the machinery and deliberations of the S.P.E.E. Committee. And I therefore regard such items as our Committee business and so report it.

The Committee's recommendations decided upon at the Pittsburgh meeting were forwarded to Colonel Beukema in my letter of July 19th, copies to members of the Committee. I was asked by Colonel Beukema to present this report to the general Advisory Committee at its meeting in Washington on July 20, which I did. I might add that much of that Committee's time was devoted to the issues thus raised.

The following is a list of items included in the S.P.E.E. Committee's report of July 19 to Colonel Beukema, and the action of A.S.T.P. with regard to them:

1. A recommendation with respect to a proposal to change the chemical engineering curricula to 11 terms leading to a degree. The Committee's negative recommendation was followed. (*Note:* The negative recommendation was merely on the grounds of inappropriateness of the proposal as it related to the objectives of the Army Specialized Training Program, which were directed toward training men for service *in the Army;* the proposal would be most appropriate if the purpose were to train chemical engineers for industry.)
2. A recommendation by the Committee that accumulative STAR unit records of students be sent to institutions in advance of arrival of students. This recommendation was accepted as follows:

   "Arrangements have been made for the training units to receive a rather complete record of the men's screening at STAR. However, it is doubtful if this can be sent in advance of the arrival of these students."
3. A recommendation that students who do not wish to take A.S.T.P. training not be urged to do so. As a result of this recommenda-

* Presented at the meeting of the Division of Administrative Officers, S.P.E.E., Drake Hotel, Chicago, Ill., October 25, 1943.

tion the following policy was announced:

"While no general rule can be devised to meet this situation, experience has clearly shown that the assignment to A.S.T.P. of a soldier who is completely hostile to the idea creates a situation which is destructive to the morale of not only that man himself but of many who are in contact with him. In such cases, moreover, the disgruntled trainee usually eliminates himself within one term or less through academic failure.

"However, it must be pointed out that participation in the program is a military duty for the best interest of the Service. To eliminate from the program all potential trainees who are not wholeheartedly enthusiastic about it would violate that principle. In addition, it would prepare the ground for sabotage of the program in units anxious to avoid the loss of personnel.

"Between these two extremes classification boards must find a solution which settles each case on its merits. It calls for more time and trouble on the board's part than can be found under any system of mass processing. A conscientious effort must be made to assure that the candidate understands fully the objective, procedures, etc., of the program. If, after that, he remains not merely doubtful and hesitant, but actually hostile to the idea, the best interests of the Service will be served by his rejection."

4. The recommendation that the A.S.T.P. contracts be written in accordance with the principles enunciated, namely,
   *a.* Normal academic standards of the institutions shall be maintained.
   *b.* Normal economic standards of the institutions shall be maintained.
   *c.* Actual cost of operating the A.S.T.P. program shall be met; there shall be neither profit nor loss to the institution.

   Discussions with the officers of the A.S.T.D., as well as in the general Advisory Committee, disclosed that there had been no revision of fundamental policy regarding these points, and this fact provided a basis for discussion of other items, especially those relating to contract negotiations.
5. The suggestion that if the above principles were in effect, there be a clarification of procedures practiced by contract negotiators in applying rigid numerical rules with respect to faculty loads, the number of students per section, charge for use of facilities, etc. This recommendation was discussed at great length with the result that
   *a.* A revision was made of certain sections of the negotiator's handbook, making it clear that the formulas included were intended as guides and not as rigid requirements;
   *b.* The number of contact hours used in the illustrative formula was changed from 20 to 18, and the

method of computing charge for use of facilities was revised (not however to include the method suggested in our memorandum);

*c.* Copies of the negotiator's manual, formerly restricted to Army negotiating personnel, were to be placed also in the hands of the college authorities.

6. Comments regarding the question whether the A.S.T. Program is too heavy. This difficult question has been the subject of continued study by the A.S.T.D., and the final answer is not yet obtained. The principal factor among a number that complicates the issue is that the screening process in the first months of the program was defective. Thus, students were included who, however intelligent, were quite hopeless on account of a lack of prerequisite training; and of course others who had neither the ability nor the background. Hence any college program would be too heavy for them. At the present time—as of September 20th—it seems clear that the screening program is at last reasonably well organized and this will presumably remove in the future this factor of ineffective screening. But I must say that, even assuming uniform screening at the new level, it is still not clear whether or not the programs, especially the Advanced Terms, are too heavy. Accordingly, the study is being continued. As to other factors affecting the question, I might add that the extravagant use of students' time—guard duty, standing in lines, early call, etc.—appears to have been one of the transient problems which are gradually disappearing as the college administrators and Commandants have worked together to make the program effective.

Another point discussed at Pittsburgh but not formally reported upon was the proposal of A.S.T.P. headquarters to establish procedures of evaluation and assistance in the Service Commands. It seemed that since the E.C.P.D. had developed machinery for similar purposes in connection with the accredited list of engineering curricula, the A.S.T.P. would do well to take advantage of that experience and not start from scratch, as contemplated. This view was presented to Colonel Pumphrey on July 15 and again to him and Dr. Rubin on July 20th; and the suggestion was made that President Prentice, Chairman of E.C.P.D.'s Committee on Engineering Schools, and a member of our Committee, be consulted as to plans and personnel. This suggestion was accepted. The plan is being put into effect, although progress has been slow. Fitting the plan into the nine decentralized Service Commands created problems, but these are being gradually overcome; and it now seems we shall have competent, experienced people for this critical job of evaluation and assistance.

Then there was the difficult question of tests. The battery of tests first adopted for A.S.T.P. proved not to be wholly satisfactory and it was decided by A.S.T.D. to review this problem. It happened that here too we were in position to offer some help. As most of you know, a joint project of S.P.E.E., E.C.P.D., and the Carnegie Foundation was undertaken some months ago in which a battery of tests has now been prepared and, to a lim-

ited extent, tried out. The purpose of the tests is to determine, at the high school graduate level, whether it is probable that the student can complete a normal engineering curriculum successfully. Colonel Pumphrey was apprised of this development and advised to have his staff explore the possibility of using on the A.S.T.P. problem the resources of this new enterprise. This was done, and A.S.T.P. is now trying out the battery on an experimental basis, under the guidance of the director of the joint enterprise—K. W. Vaughn.

And finally, I would report that the services of the S.P.E.E. Committee were offered to Dean J. W. Barker, Special Assistant to the Secretary of the Navy, and he replied that since for some time the Navy has had an advisory committee of educators he would wish to coöperate by having the President of the Society on the Navy's committee. This has been arranged.

The wholehearted coöperation of Colonel Beukema and his entire staff with our Committee and the serious consideration they give to any recommendations the Committee makes, whether on its own initiative or at their request are, I think, reasons for satisfaction and for confidence regarding the future.

# Current A.S.T.P. Developments*

By LT. COL. T. D. PALMER, JR.
*Deputy Director, A.S.T.D.*

When I received Dean Macquigg's very cordial invitation to address this important meeting, I thought there might have been some mistake. While I have talked to many groups when I was assistant business manager of the *New York Times,* and as a representative of our diplomatic corps in the Middle East, my close association with the educational institutions of this country has been of rather recent date. I, therefore, have not the temerity to stand here and discuss with such experts in the field of higher education, the detailed workings of our engineering section. In this regard, both you and I are fortunate in having with us Lt. Colonel F. H. Pumphrey, chief of that section in our division.

However, what I shall do is try to bring you up to date as to what has been happening to A.S.T.P. since your last meeting in June—the advances that have been made and some of the problems which still face us.

Before doing this, I wish to pay tribute to the very concrete assistance which the Society for the Promotion of Engineering Education has rendered the Army Specialized Training Program. Believe me, the Army is deeply grateful. You who represent institutions which are training our soldiers have done yeoman service in overcoming the many difficulties with which you have been confronted. Your president has been indefatigable in helping us—both as a member of the A.S.T.P. advisory committee and in the formation of the special committee of engineering deans which is working under Dean Macquigg. I want at this time to pay special tribute to the help that this committee has given, and is giving, us. I understand that they are taking time from their very busy program to meet this evening to discuss A.S.T.P. matters.

## A.S.T.P. Progress Since Last S.P.E.E. Meeting

Now I would like to tell you a few, just a very few, of the things that have been happening since you last met. When you met last in June, there were 75 institutions being used in the Army Specialized Training Program. As of this date, there are 222—an increase of 135, or 180 per cent.

At that time the total number of men in the program, including those at STAR units, was 45,700. Since then, 92,700 additional soldiers have entered this training. We now have approximately 140,000.

The number of advanced engineers has increased from less than 2,000 in June, to over 14,000 now. Those in basic training, from 13,000 to 75,000.

So you can readily see that a new

* Presented at the meeting of the Division of Administrative Officers, S.P.E.E., Drake Hotel, Chicago, Ill., October 25, 1943.

phase is being entered. The infant has been growing rapidly. He has begun to walk. Full maturity, as far as our ceiling of approximately 150,000 is concerned, will be reached early in December of this year.

Some 5,000 of the above 140,000 represent the seventeen-year olds, who are called A.S.T. reserves. These young men are being given the equivalent of a military scholarship until the end of the quarter in which they reach the age of eighteen. At that point they will be called to active duty, sent to military training camps, and if all goes well, will return as regular A.S.T.P. trainees for the completion of their courses of instruction. The remaining 135,000 are divided into the various categories of engineers, medical and dental students, area and language trainees and psychologists. You are already familiar with them.

The numbers in the STAR classification units have been cut heavily. This will probably be below 10,000 from now on.

For the past six weeks we have been holding down the intake rate. Such restrictions will continue in force. We are reaching the level where our intake will be only enough to compensate for the losses from graduation and attrition. The simplest and most satisfactory means for holding down the inflow, as you all know, is to raise the standards of admission, concentrating the meanwhile on securing the special types which are in major demand. When the quotas of those types have been filled for any particular cycle, the remaining vacancies are available to candidates with general qualifications in the order of their test scores. The immediate results are two-fold: first, a sharp rise in the average I.Q. of the incoming soldier, to the point where it is running fifteen per cent higher than the requirements for admission to officer candidate school; secondly, vigorous protests from parents and others when men fail of admission. It is a case of the supply exceeding the demand. It is a healthy state of affairs.

### Contract Situation

In addition to the numerical increase just mentioned—of both the number of schools used and the number of soldiers in the program—you will, I know, be interested in the much better situation in regard to contracts. Last June there were only 49 contracts activated and 24 contracts signed. By the end of this month, there will have been over 321 contracts activated, and over 250 signed, and I can assure you that the Service Commands are putting all the pressure possible behind this business of getting the colleges paid and the contract situations straightened out.

While on the subject of contracts, you may be interested to know that the Under Secretary of War and the Under Secretary of the Navy, on August 7 of this year, enlarged the joint Army-Navy Contract Board, by placing three well known educators on it—Dr. R. G. Sproul of the University of California, Dr. Horace Ford of M. I. T., and Dr. R. C. Harris of Tulane University. The enlarged board has a permanent office in the Pentagon Building in Washington, and has, I believe, met twice since August. The new Army Service Forces Manual, M–102, on training unit contract instructions is a result of this board's activity.

### Utilization of End Product

One question that is uppermost in most A.S.T.P. soldiers' minds has to do with his maximum utilization in the war effort when he leaves the program, or the question "where do we go from here?" Of course, if successful, he wants to go to officer candidate schools. At first those who planned this program foresaw just this. If the program could have been started a year or two years earlier, this is undoubtedly what would have happened.

However, war is not a static thing. As a war progresses, plans must be constantly changed to meet new situations. Most fortunately our casualties have been much less than those expected. Also, officer candidate schools turned out a record crop in the early days. The result now is comparatively few openings in these schools. This condition is well understood by the rank and file in the Army. It is of course a condition which may change any day as the fortunes of war shift.

So, while the availability of graduates of the A.S.T.P. for consideration for admission to officer candidate school has been emphasized by the Secretary of War and the Chief of Staff of the United States Army, this should not be interpreted at this time to imply that a graduate of the A.S.T.P. will be assigned *directly* to officer candidate school upon completion of his course of instruction. He will be assigned to some arm, service, or component where his special qualifications and the recommendation of the commandant of the A.S.T. unit will be given due consideration. It is not necessary to add that the trainee's development under the Army Specialized Training Program will materially enhance his basic qualifications for selection.

In addition, there is a plan now under consideration which, if adopted, will make available to A.S.T.P. graduates who are recommended for O.C.S. by their commandants, a certain percentage of all O.C.S. openings.

You should know that responsible assignments await graduates of the program. Training in engineering will prepare soldiers for assignments in the army air forces, army ground forces, corps of engineers, chemical warfare service, and ordnance department. Training in medicine and allied fields will prepare the soldier for service in the medical department wherever United States troops are stationed. Foreign area and language experts are trained to meet the needs of the army ground forces, signal corps, military intelligence service, and the office of the provost marshal general. Current army needs are the determining factor in assigning them to a field of study. Since these needs change from time to time, a soldier may not necessarily be assigned to the field of his choice.

Opportunity and incentive are vital elements in the creation of that intangible called "morale." To some soldiers opportunity reduces to a single item—the chance to win a commission. Others have a broader viewpoint and are able to find satisfaction in assignment to duties for which they are peculiarly fitted. In an army so hastily built up from a handful of troops (less than those now in A.S.T.P.) to a strength of nearly eight million, misfits are inevitable. Where and how, for example, can the Army use the surplus of lawyers brought in by the draft? A.S.T.P.'s machinery provides a corrective in so far as its authority reaches. Whenever we "cut a melon"

and distribute the available graduates, as well as the 9–A and 9–L men whose qualifications have been checked, we have the opportunity to participate in the assignment of such men to the units where they are most needed. Final disposition necessarily is made by the unit commander. However, under the operation of that machinery, the few hundred we have disposed of have gone to a wide variety of duties, both overseas and in this country. A fair percentage have already gone to officer candidate school, others will follow shortly. Two hundred men were withdrawn from three institutions last week, a week ahead of their graduation time, to fill an urgent requisition. They are assured of immediate advancement in grade. Further advancement depends on their performance. Many are receiving immediate important and interesting assignments overseas. I can truthfully say that we are being kept busy to supply the demands.

### Improving Morale

Since your last meeting, several steps have been taken to help this situation of morale. I have mentioned the problem and the corrective measures being taken in connection with O.C.S. Here are some others:

1. Soldiers have been asking for a distinctive insignia. I am glad to say that a very attractive one is now in production and should be distributed next month. It is the sword of valor, superimposed on the lamp of knowledge.

2. A certificate of academic record is now awarded to every soldier who successfully completes his prescribed work. In addition, a duplicate is retained as a part of the soldier's service record.

3. Also, on the soldier's machine record card is noted his participation in the program and the course he took.

4. Commandants are being given additional capable officers. Guidons have been authorized for training units.

5. We have been much more fortunate than we formerly were in the early experimental days in regard to news releases and stories. Press, radio and magazine editors, without any urging from us, have given the program wide coverage and treated it with marked respect.

6. In addition, the A.S.T.D. is preparing and distributing the *Army Specialized Training Bulletin,* a monthly publication, for all personnel engaged in administration and operation of A.S.T.P. at colleges and universities. It provides a medium for exchange of ideas and suggestions on the program.

7. Also, copies of *"An Open Letter from the Director of the Army Specialized Training Division to Soldiers under Consideration for the A.S.T.P.,"* are distributed to all STAR units and handed to soldiers on arrival. The letter explains specific objectives, operations, etc., of the program. Among other things it flatly states that the A.S.T.P. soldier does not have to serve for a longer period than any other soldier. Rumors that they had to serve for three, five, and even ten years longer swept the country like wildfire last summer.

### The Work-Load

A major cause of concern is the trainee's work-load. Many college heads feel that it is too heavy. The problem is not new. It has been discussed repeatedly in educational conferences from the very outset of the program. It is interesting to note that a comprehensive survey by the Uni-

versity of Chicago of soldiers in the basic phase disclosed that nearly two-thirds reported the "work-load" as reasonable. Neither our advisory committee of college heads nor your committee of engineering deans has thus far been ready to declare positively that a reduction in the work-load is advisable in the interest of securing better results.

This matter is receiving intensive study and consideration of the entire situation will be given at the next meeting of the advisory committee, which has been called for next month. When I get through I hope that Colonel Pumphrey will say a few words on this and also on the new decentralized system for academic inspections by the Service Commands. You members have, I understand, been very helpful in regard to this, particularly President Prentice and Dean Hammond.

### Attrition

The matter of attrition is one of serious concern to us; no more so, however, than it has always been in every important educational project. The totals and percentages do not worry us seriously, amounting to less than 15 per cent for classes terminating the June cycle. However, the wide variations do raise questions in our minds. I am speaking here of attrition of soldiers from the training units not from STAR units. So far as we have been able to get the facts, we have uncovered the following major causes for the mixed picture of A.S.T.P. attrition:

1. The process of testing, classification and assignment, which is under the office of the adjutant general, has, until recently, been anything but uniform, particularly as to standards of admission requirements. The greatest single difficulty has been the overemphasis, by some, of the candidate's intelligence quotient and the underemphasis of his educational background. Men with inadequate preparation in mathematics and physics have, as a result, represented the great bulk of the academic failures in the A.S.T. units.

2. Standards of academic performance in the training units vary considerably. Men who would be failed in one institution are being passed in another. For some time to come this is a matter wholly under the control of individual institutions. We accept their standards as being valid. Nevertheless the time will come when graduates of the basic phase in various institutions will be sent to the advanced phase in other schools. Their performance will be a barometer of the soundness of their earlier work. In addition, time will develop our objective examinations to the point where they will provide a fair basis of comparison. When, as, and if the combined evidence indicates that an institution falls short of the War Department's requirements, a corrective will have to be sought.

3. In the early cycles schools were troubled by the late arrival of their contingents of trainees—in part at least. An overburdened transportation system was mainly responsible. Necessarily the late arrivals were seriously handicapped at the very outset of their work. By leaving a high margin of error in the commitments made by the railroads we have eradicated most of that difficulty. However, the attempt to replace at the last moment men reported as failures by your deans still results in some delayed arrivals.

### A Word in Review

I would like at this time to review briefly the real reasons behind this program. The seriousness of the army demands made on the educators of the United States.

In this month's issue of the *National Education Association Journal*, Lt. General Somervell, Commanding General of the Army Service Forces, states: "A year ago 63 out of every 100 men inducted into the Army were assigned to duties requiring specialized training. This year 90 men out of every 100 men are so assigned."

Obviously, this 90 per cent includes many elementary skills such as those obtained at vocational schools and in the industrial workshop. However, it is safe to say that a very large percentage must have this educational training at the higher level which you gentlemen are giving.

In this connection a recent study of the educational background of our our soldiers in this war, compared with the last, may be of interest.

| World War I Per cent | | World War II Per cent |
|---|---|---|
| 80 | Grade school level and below | 33 |
| 11 | High school non-graduate | 28 |
| 4 | High school graduate | 25 |
| 5 | College students and graduates | 14 |

Even with this improved educational background the specialized training which the A.S.T.P. is giving through your institutions is urgently needed.

It is the feeling of many officers in high positions that we can lose this total war on the battlefield as a direct result of losing it on the industrial front, on the home front or on the educational front.

Modern warfare demands special training. The United States is engaged in a globe-girdling technical war—a war of specialists. It requires all the traditional courage of the soldier of colonial days, and something more. The years which separate young America's fight for independence and mature America's struggle to hold it secure, have witnessed startling changes in the definition of a soldier. In 1775, raw courage, a musket, and the ability to use it were considered enough to qualify a man as a defender of his country. Today's soldier needs everything that Washington's veterans of Yorktown could boast—plus vastly more training and equipment. Rapid advance in the mechanization of armies has multiplied the demands made on our modern soldier and the standards established for him. Do you realize that a single infantry battalion in today's war uses 3 times as much equipment and delivers at least 10 times as much fire power as Washington's entire army? There is one major way to meet the problem imposed by modern strategy and technology. That is training—carefully planned, closely supervised, endlessly continued training. The high command of the United States Army has never ceased to stress this need.

As has been shown, most men in uniform today are specialists in one field or another. In many lines requiring training at the college level there have been serious shortages. The Army Specialized Training Program is designed to fill this gap. In the words of the Secretary of War, the Army Specialized Training Program is functioning to meet the needs of the various arms and services for specialized and technical training of soldiers on active duty for certain army tasks for which its own training

facilities are insufficient in extent or character.

The Duke of Wellington may have been right when he said "the Battle of Waterloo was won on the playing fields of Eton" but I can assure you gentlemen that this war will be won by intelligently trained officers and soldiers—personnel that not only has been intelligently trained for particular army duties but personnel that has the intelligence to perform these duties with the maximum of efficiency. That education is the backbone of the Army was never more true than it is today.

### Conclusion

The Army Specialized Training Program is not just a group of men in Washington. It is not just an army plan. It is not just a college problem. It is the Washington headquarters, plus the Service Commands of the Army, plus the educational group. In other words, it is a team. And as you all know, a team has to operate as a team in order to win the game.

You who are college officials and teachers involved in training these soldiers should consider yourselves as in uniform for the duration. It is your definite obligation, as well as that of the army officers assigned to the colleges, to inspire these soldiers with the importance of this training to the Army. Of course, a large percentage of these boys would prefer tossing hand grenades at the Japs. However, they are in the Army and the Army wants them especially trained. It is up to you gentlemen to see that the right spirit is injected into their training.

Remember you are training soldiers, not simply giving an education to students. You are, if you will, training men to fight and to kill. This calls for special training, a course of education with which you have not been familiar in the past. "Educational as usual" cannot be maintained in this very unusual period. This educational procedure has been new to you and it has been new to the Army. Continue to be patient, continue to be coöperative. Let us raise our sights to the real objectives. Let us form a team with everyone playing his part. Let us not become befogged by immediate difficulties to such an extent that we lose sight of the goal.

Less than 48 hrs. ago Gen. Eisenhower declared: "This is a hard war —a bitter, bloody war. Make no mistake. It will be a long, *long* way to final victory, over a bitter, rough road."

Let those who have the great privilege of being educators in this hour of need, and those of the younger generation who also have the privilege of learning, work together with the Army for a better trained fighting force so that this war will end and the forces of evil be destroyed.

By LT. COL. F. H. PUMPHREY, A.S.T.D.

I am scheduled to tell you something about the educational portion of the Army Specialized Training Program. Really it is *you* who are telling *me* about the program, and you are doing it in a most helpful way.

In the first place, many of you have been preparing quite voluminous reports in which you have included course outlines in detail, examinations, and criticisms. All of these reports are being read and checked by the staff

of the A.S.T.D. to gather a concensus of opinion regarding specific courses and the program as a whole. May I take this opportunity to thank and to compliment the many members of *your* respective staffs for the fine quality of their constructive criticism. These reports are now being used as a basis for the preparation of a proposed restatement of course content which we trust will assist in developing greater uniformity and higher quality instruction.

Secondly, through your president, Dr. Doherty, you have given much guidance and counsel to those responsible for the program. The fine spirit of coöperation and helpfulness evidence by the officers of the S.P.E.E. deserves special recognition.

Third, many of you, as members of E.C.P.D. accrediting committees and as individuals, have agreed to assist the Service Commands in evaluating the instructional standards in schools giving the basic phase program. The exact procedures may vary slightly in different Service Commands but the basic concept is established and I am sure it will be very helpful to the Army and the schools. One phase of the program includes the collection of certain statistical information on the schedule of instruction and on the training and experience of instructors. We have tried to make this as simple as possible and still supply the information needed. It is not a recurring report and will be sent to the schools at the beginning of the next term.

Fourth, many of you or of your staff will be giving assistance in criticism of tests prior to publication rather than after they have been given. In this way we hope that the testing program can become really helpful. Our objective is a one day testing program near the end of the term with the results to be used by the schools as they see fit.

Now may I take just a few minutes to discuss some general conclusions with regard to instruction in the Basic Phase?

First, the laboratory work was planned to be self-contained and require no outside study and it is still believed that this is desirable. In the case of the physics laboratory, it was originally planned as a three-hour laboratory but, in order to assist schools who were limited in their laboratory facilities, the description was arranged to permit the write-up of experiments to be separated from the laboratory.

If this arrangement is observed in laboratory, then each class hour becomes entitled to at least one study hour. In some cases the average will be as high as one and two-thirds. It is the responsibility of the administrative officers to see that the various professors and departments share equally in this study time.

In the case of chemistry it is important that the faculty should restrict themselves to study assignments which can be accomplished by the trainee (and the A.S.T.D. must develop tests which are reasonable). In the absence of laboratory the importance of lecture-demonstration is given recognition. Some opportunity, however, should be given the student to have questions answered and concepts explained. This can be done effectively only in small groups.

The A.S.T. program is not a group of unrelated courses. The importance of close coöperation between departments is demonstrated particularly in the first term where the *trigonometry* and *mechanics* are closely interrelated. Some schools meet this problem by

having the mathematical department spend the first week or two on the elementary concepts of trigonometry. In others, trigonometry and algebra are taught concurrently. The final solution may be varied but as long as the mathematics and physics departments work together on the problem, satisfactory results are much more probable.

Coöperation between the science departments and the English department to assure clear and accurate statements will also assist in obtaining the general objective.

There are many other things that could be said but I feel sure you would prefer to use the time for questions. May I close, therefore, by again thanking you and your staffs for coöperation and assistance.

# Current N.C.T.P. Developments

By DEAN JOS. W. BARKER
*Assistant to the Secretary of the Navy*

I have no prepared speech and I am going to be very brief indeed. In the first place, there has been no major change in Navy policy. The program as it was announced and as it has developed continues in exactly the same way and will continue so. The November 9 examinations which will be given to the candidates from high schools throughout the country will have considerably increased emphasis on mathematics over what was true in the April 2 examinations. That comes as the result of the experiences of the schools in the basic phase with the men who entered from the high schools into the very first semester and where difficulties with high school mathematics developed very early and very rapidly. Consequently, more attention will be placed and greater and greater weight laid upon the mathematics part of the November 9 examinations and the succeeding one, next March.

The high schools of the country have been notified of this and they have reported that they have been giving increased attention to the mathematics courses in the senior year in the high schools for the men preparing for these examinations.

The men from the V–12 program will continue to go to Reserve Midshipman's School and will be commissioned if they pass the work with you and in the Reserve Midshipman's School satisfactorily. The Navy building program, of course, is a long-range program and we have the necessary places for those who will satisfactorily complete these programs on the commissioning schedule as estimated by us for the ships which are already projected and laid down on the ways. Consequently, our situation is slightly different from that of the Army in that our building program does have to be projected much into the future and our training program can be more closely tied to the actual construction program.

The question as to work load of these men—we get very varied replies from both our commanding officers of the V–12 units and from the deans and presidents of the colleges. In

some of our very major institutions the criticism is that the men are not working hard enough, that the V–12 men are seen too much in the movie houses and so forth, and in other equally good institutions the report is that we are working them too hard and that they cannot keep up with the normal phases of the program laid down.

As we attempt to strike the balance and with the evaluation which is being given by our visiting groups on the campuses, we see no necessity for any material change in the work load as carried at the present time. However, we are continuing to give attention to these reports as they come in and if experience does indicate over the long term that either the work load is too heavy or too light, you will be given the green signal, one way or the other, as to what to do with the men aboard your campus.

Dean MacQuigg, since the hour is getting late and I do not care to get into repetition of the Navy program, since those who have Navy programs aboard their campuses already know it and since there is no change in policy, I will sit down and be ready to answer questions.

### Discussion

**H. B. Dirks:** Colonel Palmer indicated that the trainees would receive a certificate. We are having many requests at Michigan State as the results of the first term come out. We gave these to the military department but they have not given anything to the students. Do I understand that this certificate will tell them how they got along in the various courses or just that they completed, for instance, one, two, or three terms?

**Colonel Palmer:** It will be a brief record. It is a certificate of accomplishment signed and given to them as soon as they complete the course. If you have not received these yet you will get them from your Service Command Commanders. They were issued about 60 days ago.

Q. By term or final?

A. Final, on graduation.

**M. F. Coolbaugh:** A letter went out from General Dalton's office, I believe, asking for criticism of the A.S.T. program. A faculty group assembled to see if they had any common criticism of the program. They were of the universal opinion that the objectives of the program had not been given them. I note here that we say "The objectives of the program." Are we training primarily to get these young men ready for officer schools or are we training them for skilled technologists? I can find those words in almost all of the correspondence I have. It seems to me that there is a decided difference between the objectives. The officer does not have to be the trained technologist. Certainly, there are places for skilled technologists but this is an engineering program and which are we training them for?

I will find one instructor primarily of the idea that skilled technologists are what we want. I think the program falls down decidedly if that is true. You can train a skilled technologist without having English to the extent that it is had in the program, without having history to the same extent, without having geography to the same extent, and certainly it is a time factor.

About my only criticism of the program would be that it is too filled with details for that work so that my question is, is this primarily training to make officers? Since the R.O.T.C.

men were sent back there has been a good deal of doubt in our minds as to whether we are training to just make officers. It seems that they have too many already that they cannot handle. Are we training for skilled technologists? If we are the school ought to be separated, it seems to me, into a technological school or into general appreciative engineering training for officers.

**Colonel Palmer:** First of all, I would like to tell you that we are very appreciative of the replies that were given to General Dalton's letter. I might inject at this point a fact which I believe most of you are familiar with. If not, I will repeat it. Last week the division was transferred from under the jurisdiction of Major General Dalton to that of Brigadier General Weible who is Director of Training so that these letters which you have sent in are not only being studied by the Division but by General Weible as well.

In the beginning A.S.T.P. was a personnel problem, getting the soldier, getting the facilities. Now it is a training problem. In regard to your question, I do not know, sir, that I can say very much more than I tried to bring out when I spoke to you a few moments ago. The program, when it was first envisioned, was undoubtedly to train mainly for officers. Then, as I said, our casualties, junior officer casualties, were much less than we anticipated. In addition to that the crop from the O.C.S. schools was big.

I think you will find, as time goes on, and as has been our experience with the limited number that have graduated, that a fair percentage will go to O.C.S. and that the others, when they are out with troops, will qualify much quicker with the training you are giving them than they would have without this training. I say again, war is not a stationary thing. It shifts. That is one thing that has shifted so we are still training at that level and at the level below. I would say both probably. Suppose as we move up through Italy enormous casualities are received. These boys are going to have much more chance for officers' schools than you think now. One cannot tell. War is not an exact science. I tried to cover that point before.

**Colonel Pumphrey:** I would like to add just a word. I think your analysis is not quite the true picture for this reason: General Kutz is going to talk about the problem of training in the Ordnance. I know something about the training in the Signal Corps. We had a terrific time to find men with adequate background from a scientific point of view to accept the Service School training. Did you run into that same situation, General Kutz? *Answer:* Very definitely.

The training we are giving the men in the basic phase is background training. It is a basis upon which to build Service School training. It is not technological training. It is background training so these men can go to a Service school, whether in Ordnance, armored forces, the Signal Corps, the Engineers, or whatever assignment comes and have a foundation upon which the Service School can build. Now, when they become specialists, with specialist serial numbers and put in jobs as technical non-coms, and have served as technical non-coms for several months they are the logical ones to step up to O.C.S.—they have served their internship in the Army. That is the normal road of our development in engineering from *school* training through industrial experience

to administrative jobs, and a similar situation exists in the Army.

**President Coolbaugh:** Just one word. If we are to take these on general training, I think we could come to a conclusion, but General Dalton's letter said "trained technologists." If there is trained technology coming in here, I think that program will not fit.

**Colonel Pumphrey:** All right, the reason for that terminology I think I can explain because the A.S.T.D. has been doing their best to coöperate with engineering educators on getting away from calling our A.S.T.P. a course in engineering training. We agree with you that it is not a professional training program. General Dalton's statement was an effort to keep away from a terminology which would be misleading from the other point of view.

**Dean MacQuigg:** Dean Barker, have you any remarks on this?

**Dean Barker:** I do not think I need to say anything about the Navy program in that aspect.

**H. H. Langdon:** There has been no statement or inference that any of these men in A.S.T.P. would find their way into industry. Some of the boys themselves had the impression that they would be ultimately assigned to industry and, second, I was told by an administrator of engineering of one of our large aircraft companies last week that they had already received their first A.S.T.P. assignment, a graduate. They had the list of names of more and are taking some 10,000 employees. They figured on a fairly large percentage coming out of A.S.T.P. and that they would not need E.S.M.W.T. training in the near future.

**Colonel Palmer:** Primarily, of course, this is an Army program. The Secretary of War, I think, on April 17 made an informal statement that a certain percentage of these soldiers that were limited service might be used in that capacity. We are now transferring a very few to war industries. You spoke of one. There have been a handful or so of these soldiers who previous to August 1 were designated as "Limited Service" men. As you may or may not know, "Limited Service" was eliminated according to Circular 161 on August 1. The whole plan of transferring A.S.T.P. graduates to war industry is receiving very active consideration. It involves the utilization of not only Limited Service men but the General Service. That is being studied very carefully now. We might get a decision any day and we might not. Until we do we are not going to send back any great quantity. I know that the Air Force has asked us for over 10,000 engineers. We have other large demands from industry. How far the Army will go in that direction has not yet been decided.

**Dean Barker:** I can answer that for the Navy. We went up on the Hill to the Congressional Committees concerned and we were told very definitely and positively that the Navy College Training Program was to train men for the Navy and not for industry and that we were not to put in any "Limited Service" classification to handle that and so, consequently, there will be no men in the Navy V–12 unit detailed to go to industrial organizations.

**R. C. Disque:** I have brought this question up before and have been answered once or twice, but still not to my satisfaction. The thing that distresses me more than anything else in regard to the program is the fact that so many of our former students who

have gone into the Army and who, in our judgment, are superior and superlatively trained and equipped to go into A.S.T.P. at the various levels, find it impossible to be torn loose from their present assignments, whatever they are, to go into the program.

I realize what difficulties the Army has when a man gets started in a training program of some sort and how difficult it is for them to get a man into something else, but it does occur to me that it is tragic that so many of these young men after 13 weeks of training should find it so difficult to be transferred into the A.S.T.P. where they, I think for the most part, could make progress many times as great as the majority of the men who are now in it.

Why cannot something be done to follow up at least a fraction of these well qualified men so that they will not get started in a course of training away below their capabilities and so that they can be assigned to the A.S.T.P. where they will earn their money three times as fast as many of those who are now in the program?

**Colonel Palmer:** I think, sir, you are speaking of the exception rather than the rule. The Army was subjected to a broad democratic screening. Soldiers who wanted to go in and were qualified and were not considered indispensable to their unit commander or in other words were not in a key position so that they could not be relieved, and soldiers who were not in units that were being alerted for overseas duty were almost without question allowed to participate. Now, you will find this much less true from now on because we have reached the top of the barrel and you will find thousands of well qualified soldiers who will not have that opportunity because there is no space left for them. We had cases where a unit commander, say, of a technical Signal Corps unit, had a group of which 90 per cent would qualify. He could not let 90 per cent of his company go. That was one reason, I believe, why a great many men who were qualified and wanted to go could not. Naturally, when you are dealing with the figures that we are you are bound to have a good many that should go that do not go and a good many that go should not go, but I think they are relatively small in comparison to the size of the Army and the size of the program.

**Dean Disque:** Well, I still say that the Army sent back so many who were not well qualified and not as well qualified as those men whom we sent out six to nine months ago, and that is the thing that distresses me from my narrow point of view, but, of course, I see those contrasts so sharply that I really am distressed and I have made great efforts so far as I could to make suggestions for correction. When I see, as I have seen many times, well qualified men go out from our institutions and go into something that is away below their qualifications, work that requires no technological education and in some case very little education of any kind, why—

**Colonel Palmer:** Did they want to go into the program?

**Dean Disque:** Oh, very much so. We get letters over and over again. Then, so many are sent into the program who do not want to be there and who would rather be out doing the thing that the first well qualified man is doing.

**S. C. Lind:** Colonel Palmer stated that one of the ways that we could lose this war is on the industrial front, and I certainly agree with that statement.

It also seems, from what has been said here, that neither the Army nor the Navy is in a position to help in that regard. Dean Barker has told us that while the Navy is turning out men who would be qualified for industry, they will not be available. The Army trainees, even if available, will not be of any direct assistance to the industries except in subprofessional positions. It seems to me, therefore, that it becomes the obligation of this Society to give very serious consideration at once to this pressing problem because the figures that Dean MacQuigg presented to us at the beginning of the session showing that the civilian enrollment in engineering is now 41 per cent of what it was a year ago, is just the beginning. Civilian enrollment is on the way down to zero except for men in 4–F and it is my opinion that that will not be 20 per cent. It will be, more likely, 10 or 11 per cent of a normal total, in two or more years or even before that. In fact the largest engineering graduating class that we are likely to see during this war will be in December of this year because those are the men who have been permitted to continue, and you will never have, during this war, another normal situation, another normal size graduating class unless somebody does something about it. I am wondering if this Society is not the agency.

**Chairman MacQuigg:** I think the general officers would want to consider that.

**S. B. Morris:** I would like to ask about students who have to repeat courses that they have had before entering the A.S.T. program. We recognize the difficulty in having men take courses in more than one term and understand that it cannot be done, but it has occurred to me that their morale would be much better off if they are permitted to substitute some other course in the university instead of repeating some courses which they have had and in some cases where they have had years of experience, such as in surveying.

**Colonel Pumphrey:** It has been the general policy of the Division that we would permit one term for getting the men straightened out and during that one term substitutions might be arranged. Following the one term, we feel that the man should be ready to go ahead on a uniform program and so far that has been the policy that we have followed. I realize that even under those circumstances there will be times in subsequent terms when from the individual point of view it might be desirable to permit him to be excused from a class in English or a class in history or something of that kind. This cannot be approved.

**Dean Barker:** I will answer that for the Navy. Bulletin 11, I believe, is the correct number of the instructions giving the institution the authority to make the substitution at their discretion.

**Dean Morris:** Frequently a man may have had years of surveying experience or drafting experience and he might have to repeat those when he is held back for some course in thermodynyamics or something like that.

**Colonel Pumphrey:** The policy I have stated holds with the first term that they come into the A.S.T.P. even though it is in term 5. If he comes into term 5—substitutions can be arranged in that term, but when he enters term 6 he is expected to be taking a standard program.

**R. A. Seaton:** Can you give us any indication as to the probability that

men who finish successfully the basic engineering A.S.T.P. work will be permitted to go on up through the advanced A.S.T.P.? What fraction of them can expect to be continued through the advanced A.S.T.P.?

**Colonel Palmer:** That depends, sir, again on the demands from the Army and principally on the demands from the ground forces. They want a certain percentage of those who have completed their basic term. They are apparently quite short now in noncommissioned officers. It is quite likely that they may raise that percentage so that even more may be returned to the ground forces after they complete the basic training than they thought would originally go. Therefore, again, if the situation changes we will keep more in. If they need the men right away we will have to give them to them.

**Dean Seaton:** But by and large, perhaps 1 per cent or 10 per cent or 25 per cent?

**Colonel Palmer:** I think the figure was around 40 per cent. It may be reduced to around 25 per cent, something like that.

**A. B. Newman:** I wanted to second what Dean Lind said about civilian engineers in the industrial situation. I have the advantage of being connected with an institution in which I have nothing to do with the Army program; therefore I can look at the situation with some perspective as I am not enmeshed in details of operation of an Army program. I can still see the great necessity for training for the war industries. I think if you look back at what is winning this war you will find in a most important place the men who have come out of the engineering schools in the past and who have full engineering training; they are contributing more than anyone else to winning the war. Are we getting ready to kill the goose that lays the golden eggs, or are we still to be encouraged in training civilians for war industries? I speak as a dean who has a large civilian enrollment in his engineering school. Am I going to be faced with a situation six months from now when the large group of soldiers now in the basic program in the liberal arts colleges are ready to enter engineering schools, and am I going to be under pressure to shove out into the world a lot of my civilian students in order to make room for Army students? I think it would be very definitely subversive of the war effort if I had to do that. Our responsibility is still a two-way one. We do have responsibility for the Army program. We all admit that, but I think we have at least an equal responsibility toward the war industries, and I would like to see this group go on record as sustaining what Dean Lind proposed, that we should in some way or other gain assurance that we are to continue training a large group of engineers for war industries.

**Colonel Palmer:** If your group decides to go on record, do not address your communication to the Army Specialized Training Program. We are a service agency. We train according to the needs of the Army. If the General Staff and the Secretary of War decides we are going to give 5, 10 or 15 thousand soldiers to war industries they will tell us that, so your appeal should be made in that direction, I feel.

**W. R. Work:** My question relates to the one asked by Dean Seaton: I was told Friday and I have had no time since to follow it through completely that term 3 would be continued

with one-half the men eliminated which is a little bit higher than Colonel Pumphrey's figures of 15, 20 or 25 per cent. Is that peculiar to the Third Service Command or will that be mandatory in general?

**Colonel Pumphrey:** That has to do with an immediate situation. Immediately we are using the figure of 50 per cent. We believe the percentage applied 10 to 20 thousand graduates in April and May of basic term 3 will have to be materially reduced.

**J. M. Robert:** Referring again to what Dean Lind said, that we might lose the war on the industrial front, I should like to inject one other thought that we should well be worrying about and that is the selection of these V–12 and A–12 men by competitive examination which means that the best men are being selected for the Armed Services and therefore the mass quality of the civilian students must necessarily be depressed and if the war goes on long enough we probably will not have a very high grade of civilian output. I think that is something we should be worrying about.

**Chairman MacQuigg:** On so many of these things you finally reach the decision, following Dean Lind's trend of thought, of "So what?" That is the inevitable situation. The Army must come first, it seems to me, for a quick knockout. If they cannot get that, well, then of course, we must stop, look and listen.

# Training the Ordnance Soldier*

By BRIGADIER GENERAL H. R. KUTZ
*Chief of Military Training Division, Office of Chief of Ordnance*

I deem it a very great privilege and feel highly honored indeed at this opportunity to appear before you. I do so with a sense of deep humility, for after all, you gentlemen are *experts—specialists*—who are devoting your entire lives to the education of America, whereas we of the Army are neophytes who, under stress of a world cataclysm, have had a Herculean task assigned to us—the training, in a pitiful minimum of time, of millions of men in the intricacies of modern war in all its ramifications. Truly it is a stupendous job of mass education, for the undertaking of which, frankly, the Army was inadequately prepared or qualified by education, training, or experience.

Modern battlefields are maelstroms of men and machines—a multiplicity of machines of a complexity hitherto undreamed of in warfare. Airplanes, tanks, self-propelled and antiaircraft artillery, combat and transport vehicles, together with their weapons and fire control equipment, are all but mobile gun-platforms—machines designed to provide maximum fire power, to kill enemy soldiers. I shall not speak of the broader aspect of transforming the individualistic citizen into the trained disciplined soldier, the problem of indoctrinating him as to why we fight, the necessity for the combat soldier to kill or be killed, the will to win, the building up and sustaining of his morale—although these are important yes, ***vital***—factors in his education and training.

The role of the Ordnance Department is to design, develop, procure, store, issue, and maintain the machines and weapons with which the American soldier fights. To win battles, military machines must at all times be capable of operation at maximum efficiency. Being machines, they are susceptible to wear and tear, malfunctioning, and unserviceability from normal use, and are vulnerable in varying degrees to enemy action. The combat soldier is carefully trained in the operation and tactical use of his weapons, but has neither the tools, the time, nor the specialized skill needed to repair them when damaged, or when in need of major adjustment or overhaul. Hence there have very wisely been provided Ordnance units, composed of technically-trained Ordnance soldiers, especially skilled in maintaining the fighting man's weapons and transport, and in the supply of combat essentials such as spare and repair parts, tools and accessories, cleaning and preserving materials, together with ammunition of all types. As Director of Training of the Ordnance Department, all my efforts have been devoted to the training of several hundreds of thou-

* Presented at the meeting of the Division of Administrative Officers, S.P.E.E., Drake Hotel, Chicago, Ill., October 25, 1943.

sands of Ordnance officers and enlisted men—first to be soldiers, for that is fundamental, and then to become highly-skilled specialists and expert technicians, fully qualified to perform the vital Ordnance mission of supply and maintenance of all Ordnance material in the various theaters of operations.

To understand better the present training situation, it may be well to consider briefly the pattern of Ordnance training prior to mobilization.

The Ordnance Department maintained small schools with a capacity of only several hundred students at Raritan Arsenal and at Aberdeen Proving Ground, Maryland. Students were ordinarily selected, above-average, experienced soldiers. Time was not an important factor, instruction was somewhat leisurely with courses extending over varying periods of from nine months to a year. Little detailed planning was required, courses covered practically everything there was to be taught about a particular subject. There were few training aids—the weapon or item of equipment itself was usually available. There were few instructors' guides, as the knowledge to be imparted to the students was contained in the minds and experience of comparatively few veteran instructors. Schedules were quite flexible.

A master sergeant, for example, instructing an ammunition class in the intricacies of time fuzes, was not unduly concerned if students did not promptly grasp the principles involved, for it was possible to resume discussion on the following day or for several days thereafter, if need be. There was also time perhaps to visit the manufacturer of fuzes and to see at first hand how they were made.

There was even time to delve into the history of the development of fuzes—information not essential to the functioning, storage, or handling of a fuze, but nice to know, nevertheless.

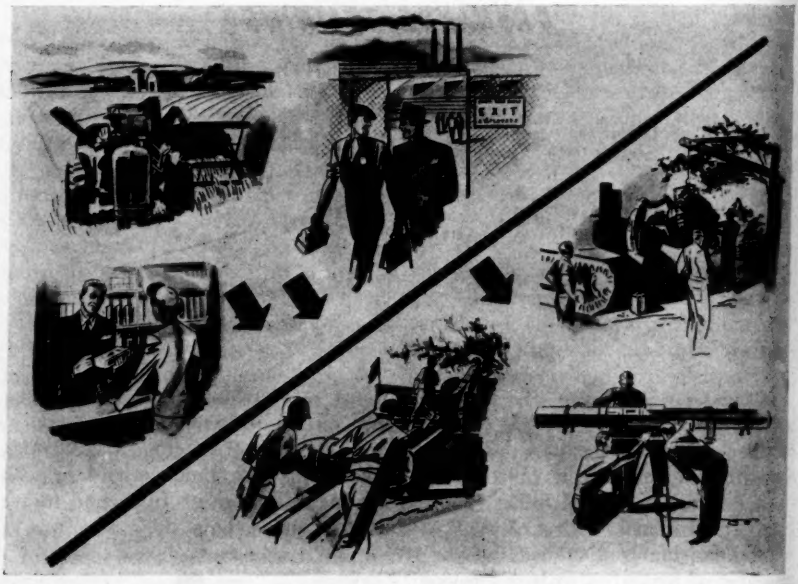
In other words, our training in those days proceeded at a pace and with a scope traditionally familiar in the aca-

demic field. We covered the subject fully, and were not greatly concerned about the length of time required.

Pearl Harbor and subsequent rapid mobilization changed all this. From the factory, the farm, and from business and the professions, thousands of men, instead of the dozens we had previously trained, poured into our in-

The fantastic increase in the number of trainees, and the limited time available were only two factors. There were many additional difficulties and problems.

The proportion of students to instructors was at first hopelessly top-heavy. This involved the selection, development and training of numerous

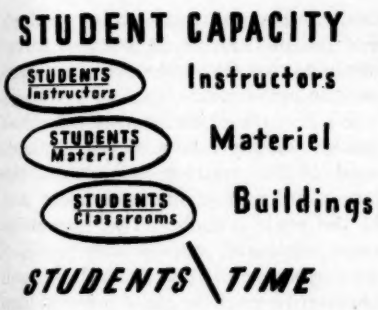


adequate facilities. It was our job to convert them into highly skilled Army specialists—experts in tank engines, skilled optical repairmen, ammunition handlers, artillery mechanics, storage and supply experts, or bomb disposal technicians—to cite only a few. Recruits were chiefly men with no outstanding technical, military, or combat background (except perhaps in the automotive field)—thousands of them, to be transformed into soldier-technicians in an *incredibly* short space of time.

instructors together with current training of inductees.

The proportion of students to items of materiel available for instructional purposes was far out of line. This required development of new training aids of various types to substitute for scarce equipment. The technical lore contained in the minds of our veteran instructors had to be transferred to printed instructors' guides.

There was the matter of the number of students in relation to the time element, and the resulting overtaxed class-

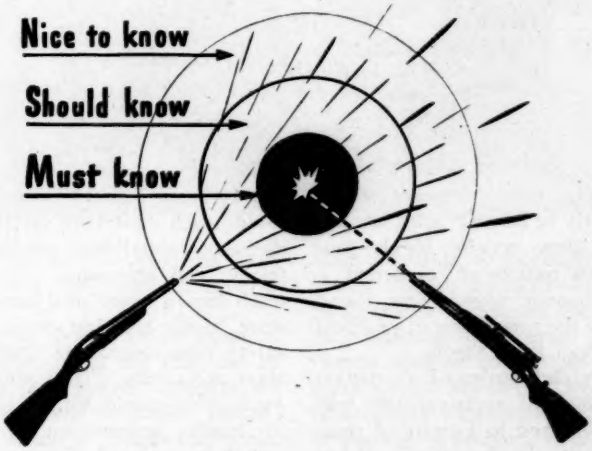



room capacities. To do the training job in the time allotted, we needed *vastly* increased physical plants, the building of which must proceed apace with training.

Over all was the handicap of a lack of technical and military background, previous experience and knowledge on the part of these men from the farms and the offices—a lack of prerequisites which *previously* were thought to be quite necessary in the training of technicians. We had to consider, too, that our students were involuntary students: that is, they *had* to be made proficient in skills in which they had no interest originally. They were going to get for the first time in their lives some real, honest-to-goodness concentrated training.

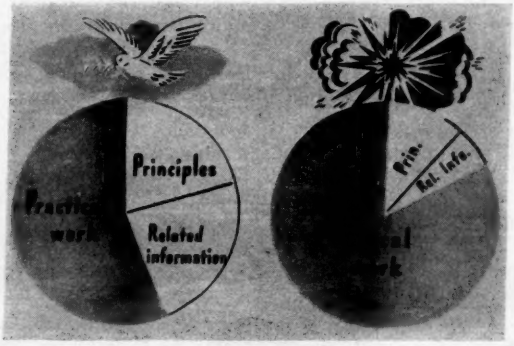
Obviously, it was not going to be possible to train these thousands of men using the methods we had employed in the past. The immediate solution was to be found in a single basic word—*planning*—intelligent planning.

It was at once evident that we would have to get along for some time as best we could with the buildings, quarters, and classrooms available, using tents and open-air instruction in many instances, until suitable construction could be provided. But we *could*, and did, immediately get busy to revamp the subject matter which we were teaching.




Representing the information to be taught as a *target*, we can divide it into three categories: "Must know" information, "should know" information, and that which is "nice to know." Before mobilization we "fired" at this tar-

get with a shotgun—that is, we taught practically everything. The skilled Ordnance mechanic was a jack-of-all-trades with a knowledge of small arms, machine guns, artillery, fire control instruments and ammunition. *After* mobilization, it was apparent that instead of blasting away at the whole target with a shotgun, we were going to have to use a rifle with telescopic sights—and concentrate only on the bull's eye—the "must know" information. The problem, then, was to carefully select from the mass of detail we had been




teaching only those elements which could properly be labeled "must know," and design clear, concise, highly concentrated new courses of instruction.

In like manner, *change* was found necessary in the proportion of practical work to school room theory.

Our peacetime courses of instruction were composed of approximately half practical work and half study of principles and related information. It has now been found advisable, however, to spend, in most instances, as much as 85 per cent of the technical training time in actual practical work. Hence, classroom theory—principles and related information—had to be condensed drastically. The end result to be attained, and the quickest, most efficient direct means to that end, must ever be uppermost in our minds.

We recognized the necessity for and quickly adopted many of the methods used in the training schools of the larger automobile manufacturers and in the trade schools. The essence in many technical courses was to teach men what actually happened without necessarily teaching them why it happened. Let us take a munitions worker for an example. Assume that a man had a basic general education. We *could* teach him ever so little about chemistry, metallurgy, mechanics, electricity, and economics, but we *must* teach him a great deal about how to store, handle and ship explosives, about safety measures, about traffic control, about accounting. Thus, while he *must know* what would happen if he failed to handle ammunition properly, he wouldn't necessarily know exactly why the results of his failure were so disastrous.

We had to train bomb disposal men. We had never had the problem of bomb disposal before. Therefore, we had to assemble the information and

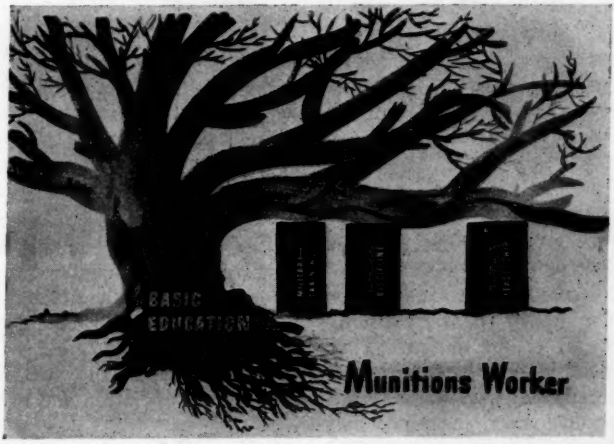
methods to be taught, gleaned from recent experience of our Allies, and train men who knew little about the chemistry of explosives, to dispose of bombs safely and efficiently. Military training, discipline and leadership are essential to and effectively help to support the structure which we have erected.

There was still one other vital consideration—the initial shortage of weapons and items of equipment available for training, and the length of time required to give students basic instruction on the item of materiel itself.

Let us take a rifle as an example. One instructor, using one rifle, can be expected at one time to acquaint six students with the essential preliminary data about a complicated item. By preliminary, I mean that explanation of Ordnance materiel—tanks and guns, etc.—about which every Ordnance soldier must know something. But with the use of training aids—and by training aids we mean moving pictures, film strips, charts, working models, sectionalized weapons or assemblies and the like—one instructor, using no materiel, can give *preliminary* instruction to large numbers of men at one time. Subsequently, of course, specialists do receive *detailed* instruction on the materiel itself, usually in groups of six or eight students.

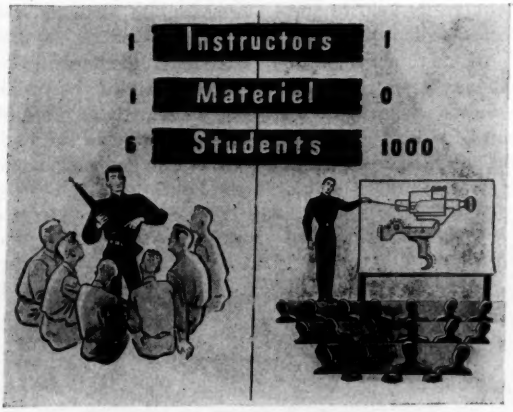
Briefly, gentlemen, I have outlined to you some of the problems confronting us shortly after mobilization.

The imperative necessity for turning out as our end product in a very minimum of time a thoroughly trained, highly skilled specialist—*not* a jack-of-all-trades—precluded the possibility of permitting our courses of instruction to continue to develop as an evolutionary process over a protracted period, during which time many changes in training equipment, visual aids, and teaching procedure could constantly be made to improve the training and approach the ideal. We believed it to be absolutely essential to so design our highly technical courses of training as to meet a specific, well-defined objective. Our aim was to produce a par-



ticular type of technical skill by the most direct methods without the inherent delay in normal evolution and without waste of precious time, effort, and training facilities. The approved solution appeared to be the creation of what might be termed *prefabricated* courses of technical instruction designed to accomplish specific missions —the theory of *course design.* That is what we call it—*course design*—but it means simply that we started with the end product ever in mind, and built our course of instruction to provide the finished product desired. It was a definite change in the method of approach in planning our instructional program. Instead of defining a course of instruction in terms of the subject matter to be taught, we attempted to define it in terms of the specific end results the trainee is expected to achieve, and of those measures and procedures necessary to accomplish this. We wanted a specific product rather than a course of study. Our friends in industry and in the educational field enthusiastically and efficiently came to our assistance with suggestions and plans, and there remained therefore only the mechanics of course design to be worked out.

It was believed desirable in designing a particular course that the con-




census of the best thinking and planning of specially-qualified men from three (3) sources be utilized—(1) the manufacturer of the equipment to be studied and taught. He would normally have all of the information regarding the operation and maintenance

of his equipment. (2) The field officer who is going to employ the skills of the graduate student, and therefore knows the minimum qualifications required. (3) The instructor who is to be the intermediary in transmitting to the student the information

which the manufacturer has, and imparting the skills which the officer in the field requires.

When the representatives of these three sources met to design a course of instruction in a particular subject they had a definite objective: To establish a course of study which would train an individual to perform a specific task.

In other words, it was like building a mould which, when filled with metal, would produce an object of definite size, shape, and form, and meet certain very definite specifications.

Conferees, after meeting as a planning committee to plan and set up the over-all training objective and the type of instruction deemed necessary, then meet in smaller groups to prepare outlines of specific phases of the instruction, decide how much time should be devoted to each phase, survey the existing text references, visual aids, films, models, charts, etc., and decide whether new ones should be developed to facilitate the teaching of the course. The final step is to prepare manuals and guides for the instructor to follow in his day to day work, with job sheets, outlines, schedules, and other essential material.

The next step was to coördinate the various phases into a unified program, and to select and equip a school in which to make a trial run of the new course, in order to test the efficiency and thoroughness of the planning work. Members of the Design Committee observed the "pilot course" during its test run, and incorporated any additions or changes which seemed advisable to improve the course. If the product of that "pilot course" met specifications, that is, if the graduates were adequately trained to perform the duties which had been laid down as the objective of the course, then the Ordnance Department was ready to institute the course as standard for the production training of future students in that particular specialty.

We were reasonably certain that this approach to our problem would be effective, but many reports from the combat zones of the several theaters have brought final confirmation and approval. Under combat conditions, our trainees have been doing well the jobs they were trained to do.

From the standpoint of the individual soldier, course design had solved our biggest problem. We now had courses of study, stripped to bare essentials, complete with instructor guides and adequate training aids, which our newly-trained instructors could administer in the time allotted, and which would turn out the desired skills in our trainees.

The next step was to apply the course design theory to an Ordnance unit. By unit I mean a weapons maintenance company, an automotive maintenance company, an ammunition or depot company, a motor vehicle assembly, or tire repair company. We found that we could design a training program that would fit a unit for its par-

ticular overseas job, just as we had trained an individual soldier to do a specific job.

In the case of units, a *mobilization training program* was designed for each specific type of unit. The training program was divided into basic, technical skills by means of courses of study which had been the product of design conferences. But the training of the unit as a whole was also on the basis of a program designed to achieve an end-product which had been determined in advance.

Initially, the officers and enlisted men were trained separately and, at various periods during training of the unit, its officers were assigned to it. Later we decided that in the interests of unity and teamwork, officers and men should be associated throughout the entire unit training period. That is the way it is done now. Officers trained beforehand as technicians and as instructors, and selected for their leadership qualities, take over from the beginning the training of the men whom they will direct and lead when the unit moves overseas to perform its assigned mission in the theaters of operations.

Special Ordnance training centers for the training of units was an inevitable development. There are now several of these large establishments in various parts of the country which have been set up and equipped for the primary purpose of training Ordnance units of various types, just as our largest school at Aberdeen Proving Ground, Maryland, is equipped to teach advanced technical skills in dozens of specialties, and as our important Ordnance replacement training center at Aberdeen Proving Ground trains replacements for units already formed. These unit training centers are turning out well-trained Ordnance units qualified to perform efficiently their field functions.

That very briefly is the Ordnance training picture of today. You no doubt are primarily interested in what we have done from the standpoint of possible application or influence of our methods upon civilian education.

Frankly, I do not know what the full implications of what we have done may be. We do not contend that necessarily the system we are now using would be desirable for civilian education, although it is probable that there may be some application, particularly in the lower echelons.

I do think, however, that the soldier, upon his return to civil life after the war, is perhaps going to demand specialized training from his post-war employer. If Uncle Sam could and did, etc. If they can be trained quickly to do complicated military jobs, and have learned at first-hand what it means to be well-trained and competent, they are pretty certain to demand suitable training for peacetime jobs.

We do feel, however, that we have achieved considerable success in solving our own specific problem. We have borrowed and used freely methods of civilian education, salesmanship, advertising, showmanship, industrial and trade school educational experience, all adapted to and interwoven with the pattern of the Army system. The excellent record of performance of our Ordnance troops overseas would seem to indicate that the methods we adopted have been justified and vindicated.

In the final analysis, I believe our efforts should be viewed simply in the light of a successful experiment in mass education and training.

# What Industry Expects of Engineering Education After the War*

By ALEX D. BAILEY

*Assistant to Vice President, Commonwealth Edison Co.*

I think I might fulfill my part of the program rather quickly and easily if I should say that industry expects better educated engineers after the war. As a matter of fact, industry was expecting them before the war. It is a continual request and need. However, being engineers and accustomed to dealing with facts, it might be well to go into more detail, particularly as you have been kind enough to ask me to express my views.

So much has been written and so much has been said on this subject, and on the subject of engineering education generally, that I imagine there is nothing I can say that would be new to you who have devoted your lives to engineering education and who know its problems, its weaknesses and their causes better than any representative of industry can hope to. This is not an apology for anything I may say—and I find that many similar speeches start off with an apology, but merely a warning that much I shall say may be a repetition of what you have heard before. If you should choose a number of representatives to speak for industry you would find that they would express themselves somewhat differently and might have different ideas when it came to details, but I am sure you would find them pretty generally agreed on fundamentals.

Speaking for myself, and I think for the type of industry with which I am best acquainted and for which I think I can speak, we have taken young engineers from universities all over the country, from the Atlantic to the Pacific, and from Minnesota and the Dakotas to Louisiana. It is true they were carefully picked, but the promising development of a large percentage of these men has renewed our faith in the coming generation and in our engineering education. Considering possibly that industry does not know exactly what it expects from the engineering schools because many in industry are not sufficiently well acquainted with the work which these institutions are carrying on, I should say that industry has got what it deserves from our engineering schools and maybe more. Possibly the engineering schools have done more than their share in the coöperation that is so necessary between them and industry. They have made an honest effort to anticipate industry's needs and have attempted to meet them so far as good engineering education policies and limitations would permit.

There has been considerable talk of late regarding the short-comings of

* Presented at the meeting of the Division of Administrative Officers, S.P.E.E., Drake Hotel, Chicago, Ill., October 25, 1943.

engineering education; that engineers should know more about history, English, social sciences, etc., and right here I should like to take a few minutes to defend the engineering college. Much of this lack is due to the type of education which our young people are getting in our public schools. If the colleges had better trained young men and women to work with they would doubtless turn out a better product and could devote their time to better use than at present, for they would be relieved of a certain amount of educational responsibility. We know that habits are formed in the early years and that our ability to memorize is the keenest at that time. Also, that the older we get the more difficult it is to change our habits of study and of conduct, consequently our engineering schools are at the mercy of our public educational system. However, please do not think that this can be used as an alibi.

The war has upset practically every line of activity in this country, including education. The demand for engineers and technically trained men has increased beyond belief. From an education standpoint it may seem that the demands of the armed forces have brought about a type of inferior education; but I am wondering if this present crisis has not merely served to accelerate a trend which had been developing over a long period of years. We are advancing technologically at an accelerating rate, but educationally we may be moving in the opposite direction. In other words, we have been putting an increasing emphasis on engineering and a decreasing emphasis on education, and yet we all know that in order to fulfill his proper destiny the engineer must be an educated man.

Referring again briefly to our general educational policy, can we not agree that expediency has too often been the controlling factor in the past just as we find it at the present time in an aggravated form. A practical engineering education has been recommended with a heavy accent on "practical," less on "engineering," and least on "education." Those who advocate this type of education probably have in mind trade-schools and have not distinguished between that type of education and an engineering education, which should be something entirely different.

Our engineering schools can probably be justly accused of over-specialization. This, of course, is in answer to a popular demand generally by those who do not appreciate the value of a fundamental education. A formal education which is devoted to a special subject does not make the best citizens as the recipient generally becomes so involved in his subject and so narrow in his thinking that he is never able to acquire a broad point of view, and he never acquires the information on general subjects or takes an interest in them, which is so necessary for good citizenship in a country such as ours. Industry itself is beginning to realize that in its own training of men there can be too much specialization both for itself and for the individual. Men who are to be leaders in any industry must have a broad knowledge not only of that particular industry, but of its relation to others and its place in the economic structure.

Our form of government, our type of life and our ideals demand a fundamental education which is broad enough to give the possessor a good perspective rather than a narrow view of some highly specialized field. Let us leave it to industry to take care of

the specialization after the undergraduate work is finished, or let those desiring to specialize continue with their studies leading to advanced degrees. Industry is encouraging specialization for its own needs and supplying the opportunities.

To emphasize the versatility of our engineers, I should like to tell you that we have tried civil engineers and electrical engineers on mechanical work, at least on work which we normally consider in the mechanical field, and conversely have used mechanical engineers on electrical work. Maybe we were fortunate in the men we picked, but we have found that with a relatively small amount of special study they very quickly adapted themselves to the new environment and not only became interested in the work, but progressed along with the others who were educated and trained for that particular kind of work. Looking back over our own personal histories, I think each one of us will wonder why the young people in our engineering schools picked out some particular type of engineering. From meeting with vocational guidance groups I am convinced that most young men are attracted to some particular branch of engineering, or possibly engineering itself, by the fact that they have heard that there is a great demand for engineers or they know someone who is a practicing engineer in a particular line who has been eminently successful in a financial way, or they follow the lead of others in their group who for one reason or another have developed some definite ideas about the type of education they want to follow. I say this to emphasize the fact that our undergraduate work in engineering education might be more general and the specialization left for later years.

Possibly another fault with the educational system, and in this can be included under-graduate education leading to a bachelor's degree, is that the educators have taken a leaf from industry's book. Our mass production in industry has been one of the wonders of the world and has contributed so much to our way of life and its enjoyment. Mass education, however, is an entirely different matter, for you are not dealing with inanimate things but with human beings, each one of whom is an individual with individual characteristics—no two are exactly alike, nor will they respond similarly to similar treatment as we expect industrial materials to behave and to conform. Furthermore, each one considers himself an individual and inwardly revolts at being considered a part of a mass, an unimportant unit in a group. In this country particularly, the individual has been a dominating factor and it is important that we recognize this in our educational work. Probably our mass education processes have brought about reductions in cost just as mass production has done in industry, but again I am wondering if we are not wrong in attempting to place a money value on education. Of course by reducing its cost we make it available to a greater number, which is an argument difficult to answer. We undoubtedly are getting what we are paying for, but I am not sure that we are getting all that we can afford. During their school years we are working with children and young people at the time when they are most susceptible to environment and associations; when their minds are grasping for information and are most tenacious of that which is acquired; when they are forming habits which will stay with them through life. Education is not entirely

a matter of book-learning or of memorizing lectures—much of it we receive by association with other people and from personal experiences; and we are influenced very largely by the type of people with whom we are in contact, particularly those who are our instructors.

The ordinary young man has a limited amount of time which he can afford to spend in school. The great majority, of course, get no further than the high school, but the one who attempts a college education will have spent a quarter to a third of his life in preparation for a bachelor's degree. He has been undergoing a formal education for about sixteen years, which to most of us seems long enough. Industry does not want to wait until he becomes so old that he has lost his enthusiasm and initiative.

Please do not think that I got out of the wrong side of the bed this morning, that I have a bad taste in my mouth, or that I consider the situation hopeless—I merely consider that education is one of our greatest problems and should be our greatest asset.

Now to get back to the subject: Industry expects and needs well educated men and women. We expect the engineering schools to choose carefully the best of the talent presented to them, though I shall have to admit that we may not agree on how you should make the choice—probably you know how that should be done better than we do. The graduates from your schools should have a fundamental, technical education with a thorough understanding of engineering habits, engineering methods, and engineering ethics. The engineers you turn out after the war must be better than the ones you were turning out before the war, and each succeeding year must show an improvement in the quality of your product.

You may not have time to give these young people courses in the social sciences, in business methods, in the humanities, and in cultural subjects, but they should understand their place and the place of their profession in our social structure. They should be given to understand that their qualifications fit them to be the peers of any in the other professions and that they can meet them at least on even ground. They should understand that since their profession is dedicated to the service of mankind, and to the improvement of man's lot on earth, they should know something about man himself. They should study people and should know people. They should study the other professions which have more intimate dealings with people and which depend for their success on their ability to handle people and to get along with them. Engineers should be taught that the ethics of their profession are the finest and that the engineers' habits of study and conduct, and the education and training they have received qualify them for any problem in industry whether it be involved with the handling of materials or people. If they are to be real engineers they must know people.

Our human relations problems have probably undergone greater changes in the last few years than in any period in history, and are becoming the most important problems in industry. If you do not believe it, listen to the discussions of any group of men in industry today and you will find that the argument invariably winds up on the subject of human relations. No matter how fine a man's technical qualifications may be, in order to take an

important place in industry today he must know people as he never knew them before. He must be able to differentiate between the good and the bad, the true and the false, the worthwhile and the unimportant. He must study and know the reactions of people just as he studies and knows the reactions of material things, and the way materials respond to treatment.

Investigations have shown that engineers have a greater opportunity to become leaders in industry than men with any other type of education. This is a great tribute to our engineering schools, but it is not surprising when we consider that we are living in a technological age. The engineer must continue to play an increasingly important part as the influence of technology grows. However, the importance of human engineering has become so great that it is an absolute necessity for the continued progress of industry. If the engineer fails in this assignment he may find that those in other professions who are less qualified, will assume duties rightfully belonging to him, thus belittling his importance and that of his profession.

So anything that you who are running our engineering schools can do to fit these young people to be good citizens and to give them a proper understanding of their place in our social structure will benefit not only industry but our profession and our nation as well.

And now that I have finally got around to my old hobby of human engineering, I think it is time for me to quit.

# Prewar Engineering Schools in a Postwar World*

By EDWIN S. BURDELL

*Director, The Cooper Union for the Advancement of Science and Art*

In accepting the assignment by Dean MacQuigg to discuss needs and trends in technical education, I was moved by the conviction that engineering schools face a sharp cleavage with the past. "Crystal gazing" is so general nowadays that we are all becoming impatient with the seers and bored with the prophets. On the other hand, one must be a good soldier in wartime, and carry on "as directed" even at the risk of going overboard into the deep seas of speculation. Because so much of what has been said is suggestive of the nebulous and the unreal, it behooves those who are charged with the education of engineers to temper their thinking with an appropriate mixture of realism and idealism.

The following remarks constitute a summary comment on nine significant aspects of education rather than a comprehensive exposition of postwar problems. Were I to narrow my discourse to a single sentence, I would without hesitation give expression to the thought that we will be faced with prewar engineering schools in a postwar world!

In other words we shall enter the postwar period with a group of schools which have long established faculties, curricula, and traditions. We can be certain that these factors of conservatism will prevent the adoption of starry-eyed proposals contemplating revolutionary change. What I am concerned about is the possibility that reasonable and sane suggestions for an orderly adjustment to postwar needs may be shelved on the specious pleas that we haven't all the facts, and hence cannot be sure of our ground. However, some of the adjustments that we shall have to make may be anticipated even now, and it is my purpose to discuss those relationships which seem most likely to require reconcilement with new conditions.

## 1. Basic Assumptions

In addition to the conservative factors noted above I would like to point out a milestone in engineering education which provides an important landmark for postwar policy. I refer to the Report of the Committee on Aims and Scope of Engineering Education as published in the March 1940 issue of the Journal of Engineering Education, and in particular to the stress which that Report places on the two basic elements of engineering education—the scientific-technological and humanistic-social stems as an integrated and interrelated program. I would go further than the Report and say that the undergraduate engineering program should be limited to four years. This limitation would force a sharp pruning of the present

* Presented at the meeting of the Division of Administrative Officers, S.P.E.E., Chicago, October 25, 1943.

specialization in undergraduate curricula. There is too much in the program now for four years. To be specific, let me mention the titles of such subjects, taken at random out of the catalog of a leading engineering school, as *The Storage Battery, Central Station Design, Prospecting, Transportation and Storage of Food.*

Industry must share more responsibility for training and education at graduate level. Specialization will, therefore, take place at the graduate level not only in a given field but within a group of industries within that field.

Undergraduate training should be sound so that graduate engineers may be able to shift between specializations, within an engineering field, without loss of time except for specific retraining. The president of one of the largest oil producing and marketing companies told me that his company is prepared to give industrial leaves of absence to enable promising young engineers to return to graduate school for further specific advanced training.

Accelerated programs were adopted by engineering school faculties against their better judgment in an outburst of wartime patriotism, and should be abandoned as soon as the war emergency is over.

The attempted assimilation has been too rapid. The constant pressure of a year-round schedule has had a stultifying effect on both teacher and pupil. Adequate periods of change of activity and environment are badly needed.

Under present conditions the teacher does not have the time necessary to organize new material and to keep pace with the latest developments in the field. He suffers inevitably from a staleness which permeates the entire staff and reduces educational processes to drills and exercises. The inspiration of vigorous teaching is lacking.

Three months' "vacation" may seem too much to a businessman whose idea of a holiday is a hunting or fishing trip, or a prolonged period on the golf links. Actually the so-called vacation is usually devoted to catching up with the professional literature in the field, planning new or revising old courses, research in libraries or laboratories, specific employment in industry, professional consultations, and the like. The current elimination of this uninterrupted respite from class duties threatens not only the health and freshness of the teacher but also the standards of instruction which are of equal concern to college authorities.

As for students, their rate of absorption is noticeably less under the accelerated program, notably because of the lack of background which summer employment in industry has provided in past years. It has become necessary to repeat and repeat and repeat in order to get across the fundamental principles in each course. No matter how much illustrative material can be assembled by the teacher, the student lacks that appreciation which industrial participation provides, and his understanding of engineering principles is very superficial.

I do approve of the California proposal to run full academic programs in its state junior colleges and universities the year round in order that students and faculty members may adjust their program to the season of the year, and to personal, social, and economic situations. Under the California proposal, individuals would be expected to study or teach three quarters out of four, or two semesters out of three. Of course, some extra costs will be involved in order to provide an adequate staff for

what corresponds to the present summer semester. I can envisage a situation where for some individuals and in some climatically favored localities it might be preferable to pursue the academic program the year round. I have heard a dean of engineering in a southwestern institution in a non-industrial region say that his students preferred to finish up their education as soon as possible and without interruption because of the lack of suitable employment during the "off" semesters. Ordinarily, however, both students and teachers need a change, and most of them a rest at fairly regular intervals during the four-year program.

### 2. Undergraduate Engineering Education in Relation to Industry

It would be helpful to engineering schools if industry would be more definite as to what it wanted engineering students to know and to be able to do. Efforts on the part of engineering schools to analyze industry's wishes too often have brought contradictory, confusing, and meaningless replies. It is possible that the engineering educator has sought counsel from men in industry who are too far away from their own engineering school-days. Perhaps we should consult more recent graduates in our efforts to locate specific deficiencies and superfluities in the undergraduate engineering program. Apparently we have consulted those engineers in industry who speak freely about what is wrong with our product but who do not take the trouble to sit down with us and tell us what they need and what they want.

I know that the Engineers' Council on Professional Development is constantly working on this problem; nevertheless, it is the responsibility of the engineering educator to make some clearcut hypotheses and to check these assumptions with industry.

Most frequent criticism is that engineering college graduates do not show sufficient administrative ability. Industry should realize that no school creates ability. Many of us have noticed that employers have expressed distrust of young engineers trained in college in industrial management. Perhaps these men have not measured up to what their superiors expected of them because their fundamental engineering training was too diluted by non-engineering subjects. Therefore, they were not good engineers and hence they did not turn out to be satisfactory junior executives. The corrective seems to be to stick to fundamentals at the undergraduate level, and train for management only those who after demonstrated ability in industry appear to be worth training further in the field of management at the graduate level. This is one more reason why industrial leaves of absence are the most efficient way to prepare men for superior industrial positions.

### 3. Reorganizing the Undergraduate Engineering Curricula

Undergraduate engineering education lends itself to a reorganization on a more rational plan based on areas of instruction. The liberal arts designation of freshman, sophomore, junior, and senior years are relatively meaningless. The three main divisions or blocks in this plan would cover fundamental sciences, basic engineering, and advanced technology, but in each field of engineering the content of all but the first block would necessarily vary appreciably.

The fundamental sciences are so common to all fields of engineering that it would be possible to accommodate them in one block of three semesters.

The second block of basic engineering would be somewhat different for each field, though all fields would have some common subjects.

In the third block of advanced technology, probably all of the subject material would be entirely different in each field.

This block arrangement permits an evaluation of the student's progress and the prospects of his continuance. If such an evaluation shows that the student should not continue beyond the first block, he has obtained certain educational values which qualify him for positions at sub-engineering level. Likewise at the end of the two blocks students who have demonstrated that they should no longer proceed with their engineering education have acquired enough facility with some of the engineering subjects to fit them into non-professional levels in industry.

In view of the relatively low percentage of entering students who graduate from our engineering curricula, we do have some responsibility to see to it that the boys who leave us without getting a degree are properly guided to a useful vocation or to completion of an academic program in some field other than engineering.

In the matter of achievement tests, I recommend only those tests which measure ability to attack and successfully solve an engineering problem, rather than subject matter coverage. The former type of test is much more difficult to set up because it involves, first of all, a clear idea of what we are expecting the student to achieve. Perhaps this is one of the most important bits of "unfinished business" that we have left over from the prewar era—exactly what have we been trying to do in terms of end product?

I have no doubt that in reorganizing the undergraduate curricula we shall want to modify our existing teaching methods. I believe that the visual aids recently developed by the Army and Navy as part of their training techniques have much to offer us in finding a new approach to the presentation of descriptive material.

### 4. Technical Institutes

The useful functions of the technical institutes in American education have been ignored too long by the engineering schools. The natural interests of these two types of institution are really closely related to one another but it has been my personal impression that some engineering educators have not only ignored the technical institutes but have actually reacted in a manner that seemed to indicate that they were afraid of them. It seems unthinkable that the two institutions can be considered competitive. As a matter of fact, the engineering educator should welcome a strong educational institution which would take over the training of those young men who, upon high school graduation, should either enter industry at once or prepare themselves for it with the least possible delay. Much pressure to enter the engineering schools would be relieved if communities were supplied with institutions which offer training at a level commensurate with the intellectual capacities of the average industrial and business employee.

Perhaps one reason why technical institutes have not received more enthusiastic recognition either by indus-

try or by engineering education is because some of their leadership has not been sufficiently broad and their sights have been set low on limited vocational objectives. Perhaps the most fortunate thing that could happen to the technical institutes would be for them to organize for themselves an accrediting agency which would assure the sharing of the experience and standards of the best institutes with those of lesser competence.

Also, industry has been able to get engineering graduates to start in those apprentice jobs for which technical institutes are trying to prepare their students. Until the supply of engineering graduates diminishes to the point that a graduate can demand a better starting position than a technical institute product, the latter will have little chance of competing.

### 5. Coöperative Engineering

Most engineering educators agree that one of the defects of present undergraduate programs is the lack of acquaintance with industrial processes and industrial organization which exists too often throughout the entire four years. It has been adequately demonstrated that students who are working in an engineering job absorb much more rapidly scientific and engineering principles.

One difficulty in the past with evening courses has been that the relationship of the daytime job and the evening educational program has not been coördinated. Therefore, the results have been mixed, depending upon the fortuitous combination of job and studies. Once this situation is corrected, as we hope it is being corrected at The Cooper Union, we can assure a prospective employer that our evening school product is equal to, if not better than, our day school product at the time of graduation.

Strictly speaking, the term "coöperative courses" applies to that situation where daytime employment is alternated with daytime studies. While the length of this coöperative program will be more than four years, especially if adequate rest periods are provided, as they should be, maturity of thought and behavior will be achieved and a pattern of life will be created in which study and work can be carried on simultaneously. More youths will be able to continue longer in college because they will earn while they learn, and thus overcome personal and family financial difficulties. Such industrial research, as might be taught at the undergraduate level, would be carried on with full scale equipment in the factory itself.

Coöperative education should not be adopted, however, solely as a means of getting more boys through school or as a means of reducing capital expenses and operating costs. Unless the system can be justified from an educational standpoint, and from a practical standpoint by getting proper support from industry, it should not be adopted.

There is no reason why this closer coördination between theory and practice need rule out the broader educational objectives such as humanistic-social studies nor reduce engineering college education to a mere vocational trade school level.

Coöperative education should be as operable in the liberal arts and in the fine arts as in engineering.

Coöperative education should be possible at the high school, junior college, and college levels.

### 6. Demobilized Soldier, Sailor, and War Industry Worker

Almost all veterans will have had a smattering of mechanical training. The Armed Forces Institute may be relied upon in general to assign educational values to this training, but engineering educators should assure themselves that evaluation at the college level is in the hands of persons familiar with engineering school standards and practices. The proposed "profile" that is to be made available for every veteran must be significant not only from the standpoint of general education, but must be useful to the engineering school admissions officer.

The greatest danger involved is that the veteran, amply supplied with Government money, will buy those courses of training which are most glamorously described and which are the quickest and apparently easiest to absorb. One may guess from the type of pseudo-scientific advertising that we see in the current magazines that there will be a rush for jobs in electronics, plastics, air conditioning, etc. Proprietary schools will do a land office business in these so-called engineering courses.

It may be difficult to convince these veterans that a thoroughgoing scientific background is necessary to assure adequate professional performance in these fields. Even so, I believe that it is better for the veteran to make his own choices, good or bad, than to have the Government continue to subsidize our schools and colleges to carry on the mass education they are now doing for the Army and Navy.

To allow these veterans a complete freedom of choice of school and type of training may prove to be a real test of our faith in the democratic method. At the same time, we must not permit overcrowding in legitimate engineering schools in fields which really do not offer the employment possibilities that the veterans think they do.

Some consideration must be given to the natural desire of the veteran to restore his earning capacity in civilian life as quickly as possible. For them, evening engineering courses and year round day programs should be provided. Qualified but non-matriculated college students should have access to special preparatory courses so that they would not be compelled to drop back to high schools and immature associations. It is a hopeful sign that the Armed Forces Institute is taking leadership in this area, and we hope that adequate guidance will be given at the point of demobilization so that reasonable choices on the part of the majority will be made.

The engineering schools might well consider the retention of something similar to the Engineering, Science, Management, War Training Courses. These short courses have a certain flexibility, and at the same time avoid commitment of the institution and its established curricula to continuation of offerings beyond immediate and demonstrable needs. These might be called "Aids to Men in Industry" and, if given in the evening, probably offer the greatest opportunity for service on the part of the engineering school to the returning veteran and former war industry worker.

Experience with ESMWT generally has been satisfactory. It remains to be seen of course how distorted the claims of the trainees become ten or fifteen years from now. But every safeguard is being taken to avoid giving the trainee the idea that he is a "graduate" of the institution which offered him a twelve weeks' course.

The possibility of compulsory military training should not be ruled out of the postwar picture. Engineering educators will want to consider whether or not the Reserve Officers Training Corps system was satisfactory or whether as long as the program may be compulsory on a nation-wide basis the break should not be made between high school and college.

Furthermore, the extensive military reservations existing at the end of this war should be taken into consideration as lending themselves to desirable uses not only for strictly military purposes but for the physical and moral rehabilitation of youths of high school and college age by civilian agencies. College educators in the postwar era should accept their share of the responsibility for creating and supporting many innovations in the handling of youth.

### 7. American College Education in General

I have written the foregoing entirely from the standpoint of technical education and training. We must not fail to recognize that this is but a relatively small segment of the American college program. In evaluating the place of the American college in the postwar world, we should not overlook the probability of a great intellectual awakening—a renaissance of learning in this country following the war. As the explorations of the voyagers and adventurers of medieval Europe awakened in those at home new interests of world-wide dimensions and stimulated a revival of learning, so will the new world view of the American people acquired during this global war and postwar reconstruction arouse an unprecedented curiosity and interest in history, languages, economics, government, and geography.

In this connection, one of the most fundamental educational problems facing American educators is whether to go along with the present system of a four-year high school program followed by a patched-up four-year college program, or to consider a drastic reorganization such as Hutchins at Chicago suggests. President Hutchins advocates combining the present junior high school with the first two years of the senior high school, then creating a so-called general college out of the last two years of senior high school and the freshman and sophomore years of the present college. This new unit would correspond to the lycée and the gymnasium of Europe and would be the terminal unit for the vast majority of American youth.

I must confess that without fully understanding Hutchins' educational theories, I shared the popular distrust in them, but on further reflection his proposal to regroup educational units seems quite sensible to me. We already approximate it in the case of youth who terminate their education with the junior college, which is ordinarily a two-year program beyond high school and which if more widely adopted would relieve the upper college years of unsuitable material. I am frank to say, however, that I do not follow Hutchins in his return to the medieval trivium and the quadrivium as the only way of unifying and giving meaning to higher education at the university level.

Hutchins is not alone in his concern over the waste of time and effort in the American college program. Father Gannon, President of Fordham, would also drastically regroup the American system of education into six years of

grammar school, three years of high school, and three years of college, thus reducing by four years the age of youth on graduation from college.

### 8. Adult Education

I believe that adult education needs to be reëxamined and made a part of the public school system of the cities and of the state universities' extension service in the small towns and rural areas. While university extension service embraces work with adults, it has too often been administered as an unrelated group of specialized vocational studies. These studies should be a part of a comprehensive well-planned program for all adults who are interested in improving their minds as well as their jobs, in enriching their spiritual and cultural life as well as their farm lands. Perhaps youth returning from the wars as sober men and women starving for beauty and truth will demand of the educational resources of their communities something more in the way of evening courses than literacy classes, bookkeeping, spelling, and business arithmetic, and thereby astonish the unimaginative administrator, unmindful that education is an on-going process beyond high school or college Commencement Day.

### 9. "The World of Tomorrow"

My last topic I have chosen to call somewhat ironically by the popular title of the New York World's Fair of 1939—that last fling of shallow, glittering optimism between the two world wars. It is now evident to almost everyone that the theme which should have pervaded this drama is the passing of provincialism and isolationism —for they are gone for America just as surely as knee trousers have gone for the teen-age boy. There is no doubt that we shall be compelled by force of circumstances to take part in the preservation of a decent and honorable world order. America must have men and women ready to meet this challenge—men and women who, in preparing themselves for a useful life in their home community, have also acquired a sufficient understanding of world problems to support America's assumption of world responsibilities. The colleges must vindicate democracy —and this is their biggest job.

The kernel of the over-all problem of education in America is how to enlarge the people's capacity for citizenship. The corollary to this is how, through the colleges and universities, we can assure a supply of men and women of good will and ability who will provide the leadership necessary to cope with the staggering problems confronting postwar society.

The greatest danger is that we mistake the shadow for the substance and rest content with imparting the skills while forgetting the larger implications of service to society. War has created a more virile conception of the obligations of citizenship. Members of draft boards, air-raid wardens, volunteers in fire and police brigades, for example, perform an obvious and necessary service to the community apart from their normal activities as teachers, doctors, lawyers, and businessmen. We must foster this growing sense of civic responsibility and these higher standards of social conduct in all of our citizens at all times. Community rallies will not do it. Something new in our educational system may do it. That something will be faith in service and sacrifice for the common good.

# A Seminar on Engineering Education

CONDUCTED AT NORTH CAROLINA STATE COLLEGE, BY THE FACULTY OF ENGINEERING DURING THE SPRING SESSION, 1943

*Chairman,* WALTER RAUTENSTRAUCH
*Head, Department of Industrial Engineering, Columbia University*

There were eleven meetings of the faculty. The first meeting was devoted to organization of the group and consideration of the topics to be discussed. The second meeting was a joint meeting with the local branch of the S. P. E. E. at which the subject of Probability in Relation to Engineering Practice was discussed. The subjects of the remaining meetings, and general conclusions which evolved were as follows:

Prior to the formal organization of the seminar, a request for suggested topics for discussion resulted in the following:

Discussion of the overall relationship of engineering drawing to the general field of engineering.
The aims and contents of engineering curricula or the teaching of engineering.
Lecture preparation.
Reference reading.
Research—and its relation to teaching.
Teaching methods.
Trends in engineering as related to war and post war period.
Various phases of engineering interdependency with economics.
Engineering education after war.
What effect will the A. S. T. P. problem have on the engineering curricula; both present and future.
The evaluation of industrial arts courses in the training and preparation of an engineer.
Course content of engineering drawing.
Testing program for engineering drawing.
Closer correlation of shopwork (practical work) with academic work.
General engineering at under graduate level vs. specialized engineering.
The requiring of each teacher to prepare a syllabus or outline of course prior to teaching it.
How to conduct faculty meetings toward the improvement of one's faculty.

The purpose of the third meeting was to formulate acceptable procedure for conducting the work of the seminar. After some discussion on this problem it was generally agreed that the seminar should address itself to three major problems:

What characteristics or capacities do we want engineering graduates to have?

What procedures and methods of teaching and dealing with the student as a person are most likely to develop these capacities?

What changes in present procedures and methods are indicated as a result of the conclusions reached?

Some consideration was given to the first problem and the following were suggested as desirable subjects for discussion as to objectives and methods of teaching to attain these objectives:

Be thoroughly grounded in engineering methods.

Competence to solve engineering problems in a recognized field of engineering practice.

Use the English language correctly.

Ability to address a group.

Ability to write a report.

Ability to analyze a total situation and determine its characteristics. To formulate a problem.

Capacity to maintain emotional stability in trying circumstances.

To have a wholesome philosophy of life.

To understand the historical and current forces operative in our industrial economy and the relation of the engineering profession to them.

Good study habits.

To make imaginative projections.

To have confidence in himself.

Capacity to learn and accept new ideas.

To be an acceptable social person.

The suggestion was also made that professors of psychology, sociology, and other disciplines, be invited to attend the seminar at those times when problems of psychology, sociology, and so forth, are being discussed. The function of those invited guests would be to answer questions and guide the discussion in their particular fields as they are related to engineering education. The Chairman was asked to make appropriate arrangements for the attendance of these men.

It was the sense of the meeting that the Chairman should suggest the subjects for discussion at each meeting and notify the members of the seminar some days in advance of the meeting. It also seemed to be the desire of the group that before opening the meeting for discussion the Chairman should outline briefly the problems involved so as to give a sense of direction to the discussion.

The subjects of the Fourth Seminar were use of the English language and public speaking.

It was suggested that students may acquire the ability to use the English language correctly through: (*a*) imitation, (*b*) instruction in recitation, (*c*) instruction through correction of papers and problem solutions, and (*d*) through courses in English.

Members of the department of English present, Professors Clark, Wynn, and Fountain, were asked to state their views on the probable effectiveness of teaching by the above methods. The other members of the seminar then engaged in a general discussion on the problems presented. The discussion brought forth no pronounced concensus of opinion, but a suggestion was made, and liberally supported, that it would probably be very helpful if at least one member of the faculty in each of the four years gave special attention to the correction of students reports and problem solutions for errors in English, clarity of statement, and so forth.

In the matter of teaching public speaking, it was suggested that two

general avenues were open: one, through seminars under student leadership, and the other through courses in public speaking. It was further suggested that the seminars might be organized in connection with regular courses of instruction, or they might be given under the guidance of a member of the faculty at the student engineering society meetings. It seemed to be the opinion of some members of the group that it would be desirable for some courses to be given by the seminar method with student leadership.

The subject of the Fifth Seminar was engineering experiences in industry and their relation to curriculum building.

The problems which arose in the reorganization of a company manufacturing scientific instruments were presented. The engineer charged with the redesigning of this business found that the problems involved the redesign of the products to lower the cost of manufacture and for improvement in function; the selection of better machinery of manufacture; the relay-out of the plant; the control of the flow of materials in the plant; and the redesign of the organization structure of manufacture. It was pointed out that a detailed analysis of the costs of manufacture and of operating the business as a whole, disclosed the important problems with which the company was faced and indicated to the engineer the direction which his efforts should take.

The problems of reorganizing a company manufacturing a food product were then presented. These also involved an analysis of costs and more particularly a study of the economies which could be effected by the improvement of manufacturing operations. Since no data for this company were available, the data for the operations of the Class One railroads of the United States and of the Carolina Power & Light Company were used for illustration. It was shown how the operating data of these industries could be used to determine the performance characteristics of a business over a wide range of output. A comparison of operations of a business enterprise with the operations of a steam power plant was made and the similarities discussed.

The relation of these experiences to the engineering curriculum was discussed and it was indicated that engineering graduates preparing for service in the industries would be at an advantage if they were instructed in the costs of manufacture, in organization and in the methods of analysis by which the operating characteristics of industry are disclosed.

Faculty discussion was limited to about 10 minutes and was directed to the problem of applying the techniques discussed to educational institutions. It was indicated that, particularly at this time, with fluctuating revenues from student fees and relatively high fixed charges, the types of analysis presented could, with some modifications, be found helpful in determining institutional policy.

The subject of the Sixth Seminar was engineering experiences in the analysis of total situations.

The work of the engineer in determining the factors on which to base the designs of water systems, sewage systems, highways, power systems, telephone lines, and marketing systems was outlined to illustrate the need for evaluating total situations for the derivation of engineering design data. The failure of industry to be guided by the interpretation of production data made by competent statistical authori-

ties in the decade prior to 1929, was referred to as one of the basic causes for the over expansion of industry and its ultimate collapse. This failure to comprehend the total situation in industry in the past raises the question of the future responsibility of educational institutions for instructing its students in the operating characteristic of the national plant as a whole. The meeting of May 13 may throw some light on this question.

Reference was made to the economies in manufacture which have resulted from the application of statistical methods to production problems. Particular reference was made to techniques of inspection through which mass production industries not only reduce the cost of inspection, but also maintain a predictable high quality in the products made. The formulation of questionnaires, the determination of adequate samples, and the degree of reliability of forecasting were also discussed. The procedure based on statistical techniques for the design of engineering experiments was also considered. It was clearly indicated that this comparatively recently developed tool of statistical analysis had wide application in engineering practice in all fields and that engineering schools in the future should include instruction in this subject as part of the training of their students.

The subject of the Seventh Seminar was the integration of subject matter of the curricula of engineering schools.

This subject was presented from the standpoint of the increasing demand for the introduction of new courses with the expansion of engineering practices and the need for continuous emphasis on the engineering approach to problem solutions. It was suggested that as new and specialized subject matter was introduced into the curricula there was danger of loss of perspective and failure to realize the relation of the specialized subject matter to the total situation. The need for orientation of every specialized problem in engineering as part of a whole was emphasized. Attention was called to the fact that not only should there be continuous emphasis on the engineering method in all subject matter dealt with, but there was also need for maintaining a sense of proportion of the relation of the part to the whole. Reference was made to the fact that the same problem of integration of subject matter had faced teachers in other schools of the University. The work of Louis Agassiz in the natural sciences, the introduction of the case method in legal education, procedure in medical education, and the reorganization of accounting practices to accord with engineering needs were given in illustration of how the problem of integration was being met in other fields. Some references were given to experiences in teaching machine design, strength of materials, and mathematics in an integrated course and the handling of problems in mathematics by the engineering method. An experience in the analysis of the economic and social forces operative in a New England community by the engineering method was also described. This experience illustrated the ways in which the engineer, social worker and economist cooperated with a group of graduate students to set up a total problem of community life and orient the social worker in the problems of the community.

Copies of the "General Report on the Second Work Conference on Higher Education" made by the Southern Association of Colleges and Secondary

schools were distributed to the members present. A number of copies are available to early applicants who were not present at the Seminar. Particular attention was called to the following pages of the report: Second half of page nine and all of page 10, bottom of page 15, parts of page 21, the latter half of page 22, as having particular reference to some of the problems in education with which engineering faculties may well be concerned.

The subject of the Eighth Seminar was understanding the historical and current forces operative in our industrial economy and the relation of the engineering profession to them.

The importance of this subject to engineering faculties was indicated by reference to the large numbers of people working under governmental, institutional and private sponsorship on the problems of post war planning.

Reference was made to power companies, promoting community planning for the development of local resources and the employment of labor after the war; to government agencies, such as the T. V. A. and the R. E. A., systematically applying the engineering method to the development of the economy of particular regions, and to large manufacturers endeavoring to orient themselves in the economy of the post war world.

These and other illustrations given, indicated our becoming aware of the inter-dependent character of our national operations. It was also indicated that in the long run the success of one industry is a by-product of the successful operation of the National Plant as a whole.

The development of the applications of the engineering method to human affairs was briefly sketched. The history of this development seems to indicate that, the demand in the future will not only be for men competent to deal with materials, machinery and factories, but also for men who are able to apply the engineering method to whole areas and to the operations of the industrial economy of the nation as a whole.

A number of illustrations were given to show how the operations of the National Plant as a whole could be described, and trends in its important characteristics disclosed. Trends in employment, and in income distribution as between the groups who produce goods and services, and groups who serve in other capacities, were among the illustrations given.

The question was then raised as to the part our engineering schools should play in preparing men to serve the many groups now being organized to deal with the problems of the post war industrial economy. Three suggestions were put forth for consideration.

1. It was indicated that since the nature of the problems to be dealt with demanded the services of men instructed in each of the major branches of engineering practice, graduate curricula in mechanical, electrical, chemical, civil, industrial, and mining engineering should be organized for studying the development of the economies of political areas, such as the State, and of whole areas defined by characteristic resources.

2. That in each of the undergraduate curricula it would be helpful to organize seminar courses in each term to serve to focus the subject matter of the instruction during that term on projects of the above nature.

A third suggestion was that even in the preëngineering years the engineering approach to the problems of living

should be introduced that the students may get an early grasp of the application of the engineering method to them.

The subject of the Ninth Seminar was relation of the engineering school to the high schools and colleges of the state.

The procedure in organizing the integration of State College with the high schools and arts colleges of the State was presented from the standpoint of the engineering method in setting up an organized procedure.

Involved in this method are the objectives to be accomplished, the personnel available for service, the resources available to the organization, and its program of action. It was indicated that the objective should be to keep the high school and college students and their faculties systematically informed about the opportunities for service in the engineering profession. To interest the Alumni residing in the State to stimulate interest in high schools and colleges in State College as a place to study engineering. To work toward raising the standards of instruction in the high schools and colleges, particlularly in those subjects which are fundamental to the study of engineering.

It was suggested that both the teaching faculty and administrative personnel of State College should be drawn on for carrying out the activities required according to their adaptabilities, inclinations and teaching loads.

According to the funds and equipments, as well as the personnel, it was suggested that the program of action should include periodic addresses by members of the faculty at high schools and colleges, the distribution of printed matter to students who intend to study engineering, the placing of photographs from the college campus on walls of the high schools and colleges, and the organization of excursions of high school and college students to State College for the purpose of inspection of equipment and understanding the general environments of college life.

Consideration was then given to one aspect of the program suggested, namely the content of the printed literature which should be made available to prospective students. It was suggested that an endeavor should be made, through this literature, to advise the student of the opportunities offered in all the professions, as well as engineering, that the student may be in a better position to judge his interest in engineering over other professional offerings. A very complete outline of such printed literature has been prepared by the Mechanical Engineering department and was discussed with much favorable consideration. It appeared that this part of the program of action, apparently already under way, should be encouraged and that all the divisions of engineering might be interested in similar activity.

Reference was made to the growing interest of the Alumni Association in the work of State College and the help which might be secured from this Association in furthering good relations between the high schools and colleges of the State with State College.

The subject of the Tenth Seminar was the function of research in the educational process.

The educational program of an engineering college was reviewed with reference to the presentation of factual material, the acquisition of skills, the application of the factual material and skills to engineering problems to the interpretation of economic, social and industrial situations, and graduate studies in the form of investigations

and research. Since education should be a voyage of discovery for the student, it was suggested that the principles and methods of research should be applied in teaching throughout the entire curriculum from the time of entrance until graduation.

Reference was made to the increasing demand for a wider range of engineering services in the affairs of mankind and to the impact of this demand on the curricula of the schools not only in terms of new subject matter, but also in terms of new types of graduates. The influence of great scientists in teaching undergraduates and the early introduction of the research attitude and methods of approach was considered of major importance in the stimulation of research.

Since the object of education is the reorganization of life and the function of the educated man is to improve his environment, it was suggested that the subject matter presented and the methods employed in education should be identified closely with the modern problems of civilization. By this process research and graduate studies are stimulated, and the research attitude is developed throughout the entire undergraduate teaching program.

Universities, to be live organizations, functioning vitally in the advancement of civilization, should possess three characteristics; first, they should bear the seeds of their own renewal; second, be capable of regenerating their parts; and third, be resistant to the forces of disintegration. The recently published book of Dr. Robert Lynd entitled "Knowledge For What," was recommended as a good exposition of the problems which the university faces in the matter of its teaching and research programs. A university alert to and dealing with the problems of civilization was characterized as an endogenetic type of organism—inside grower—that possessed vitality by virtue of the very processes it used in carrying out its educational program. It was suggested that when colleges and universities became routine and formal institutions for training, and controlled by forces from without, they tended to become exogenetic and dominated by the repressive forces in civilization and thus became dormant and stagnant institutions.

In summary, it was suggested that the function of research was to maintain, by its methods, the vitality of the educational process throughout its entire program of undergraduate and graduate studies. Two brief statements by Professor Dugald Jackson may be referred to appropriately in this connection:

> The best part of education for youth is to come into contact with stirring personalities that have had great adventures with ideas,

and,

> Two trends . . . are . . . more responsibility placed on the individual students for self-education associated with more sympathetic and wisely directed supervision, encouragement, and counsel from the staff; and the fuller acceptance, as a tenet, of the significance of research for the education of engineering students during their upper undergraduate years.

The subject of the Eleventh Seminar was the engineering curricula in the light of what engineering graduates do 10 years after graduation.

At this the final meeting of the seminar the heads, or representatives, of the several engineering departments expressed their views on the above

topic. All departments felt the pressure of the demands for the teaching of new subject matter as their fields of practice expanded during the years. The general consensus was that while the specialized demands may have to be met by the introduction from time to time of new subject matter, it was nevertheless highly important to continue emphasis on the fundamentals of method but based on a more inclusive approach to the treatment of subject matter in the different fields of engineering practice.

Accordingly the four year undergraduate curricula are best devoted to basic training in engineering methods and such methods should relate, not only to the technical, but also, when appropriate, to the social and economic aspects of engineering practice. Particular emphasis was laid on the need for engineering graduates being adaptable to applying themselves to new and varied situations. The capacity to learn through a variety of experiences after graduation was generally considered just as important as immediate usefulness in the solution of specialized technical problems at graduation. Thus, while there will need to be adjustments from time to time in the content of the different engineering curricula, it was emphasized that the fundamentals of subject matter, in addition to mathematics, physics and other sciences, should include, where appropriate, more of the social sciences including economics. Also, while the student must be taught how to apply these basic sciences to particular problems, it is particularly important that his capacity to inquire and learn throughout the years after graduation be developed as much as possible. In the words of John Stuart Mill, we should refrain from making disciples of our students, but rather inculcate in them the spirit of inquiry.

The development of capacity to understand the total situation of which the specialized technique may be a part was suggested as our important problem in the education of engineers who are to hold responsible positions 10 years after graduation.

# New Members

BANCHERO, JULIUS, Instructor in Chemical Engineering, University of Michigan, Ann Arbor, Mich. A. H. White, G. G. Brown.

BERL, ERNST, Research Professor in Chemical Engineering, Carnegie Institute of Technology, Pittsburgh, Pa. R. E. Doherty, W. N. Jones.

BURDETT, ROY W., Professor of Engineering, North Texas Agricultural College, Arlington, Texas. J. T. Mitcham, F. L. Bishop.

CONVERSE, FRANK P., President, Engineers Local No. 18, Intl. Union of Operating Engineers, 216 High St., Cleveland, O. G. E. Barnes, M. S. Douglas.

CURRAN, THOMAS M., Associate Professor of Naval Architecture, Webb Institute of Naval Architecture, New York City. L. J. Ballard, A. H. Church.

DE JONG, SYBREN H., Demonstrator in Civil Engineering, University of Toronto, Toronto, Ont. C. R. Young, R. G. Legget.

DRUMMOND, GARRETT B., Assistant Professor of Engineering, New Mexico School of Mines, Socorro, N. M. M. E. Farris, S. B. Talmage.

DUTTON, DONNELL W., Director, Georgia School of Technology, Atlanta, Ga., G. A. Rosselot, R. L. Sweigert.

EPSTEIN, BENJAMIN, Associate Mathematician, Ballistic and Quality Control Sec., Frankford Arsenal, Philadelphia, Pa. R. D. Douglas, S. D. Zeldin, D. C. Jackson, Jr.

FOLSOM, RICHARD G., Associate Professor of Mechanical Engineering, University of California, Berkeley, Calif. L. M. K. Boelter, B. M. Woods, C. T. Reid.

FRANKLIN, JOSEPH F., Assistant Manager, Employment Dept., Lockheed Aircraft Corp., Burbank, Calif. H. L. Davis, F. L. Bishop.

HELWIG, CARL E., Lecturer, Civil Engineering, University of Toronto, Toronto, Ont. C. R. Young, R. G. Legget.

HUNDLEY, ROBERT E., Professor of Mechanics, University of Cincinnati, Cincinnati, Ohio. C. W. Park, H. B. Luther.

MAGNUSON, ELTON E., College Dept., Prentice Hall Inc., 721 Mt. Pleasant, Ann Arbor, Mich. J. N. Arnold, W. J. Luzadder.

MOCHEL, MYRON G., Research Associate, Underwater Sound Laboratory, Harvard University, Cambridge, Mass. E. A. Walker, C. H. Berry.

NIELSEN, PAUL E., Associate Professor of Physics, Newark College of Engineering, Newark, N. J. F. N. Entwisle, Wm. Hazell.

NIESSINK, THOMAS, Instructor in Electrical Engineering, University of Pittsburgh, Pittsburgh, Pa. P. E. Rush, Nell McKenry.

PARKER, S. THOMAS, Instructor in Mathematics, University of Louisville, Louisville, Ky. J. H. Simester, H. H. Fenwick.

SNELGROVE, ALFRED K., Professor and Head, Dept. Geological Engineering, Michigan College of M. & T., Houghton, Mich. L. A. Rose, James Fisher.

STEPHEN, VALENTINE H., Assistant Professor of Electrcial Engineering, University of Connecticut, Storrs, Conn. P. H. Nelson, G. S. Timoshenko.

WARRINGTON, HOWARD M., Assistant Vice-President, Prentice-Hall, Inc., 2652 E. 73rd St., Chicago, Ill. J. N. Arnold, W. J. Luzadder.

WHITFORD, DANIEL E., Assistant Professor of Mathematics, Polytechnic Institute of Brooklyn, N. Y. D. F. Othmer, C. C. Whipple.

WILLIAMS, HAROLD I., Assistant Professor of Electrical Engineering, University of Vermont, Burlington, Vt. G. F. Eckhard, L. F. Shorey.

WRIGHT, AUSTIN, Associate Professor of English, Carnegie Institute of Technology, Pittsburgh, Pa. R. E. Doherty, W. N. Jones.

ZEIGLER, FRED E., Area Supervisor, E.S.M. W.T., University of Alabama, University, Ala. L. P. Arduser, G. R. Campbell.

187 individual members + 4 institutional

# The 1944 Meeting

The 52nd annual meeting of this Society will be held in the Netherland Plaza Hotel, Cincinnati, Ohio, June 22–25, 1944. The following local committees have been appointed:

*General Chairman:* Rupert Anderegg.

*Registration and Exhibits:* G. W. Burns.

*Hospitality:* C. A. Joerger.

*Publicity and Printing:* C. W. Park.

*General Sessions and Conferences:* L. R. Culver.

*Annual Dinner and Group Meals:* E. S. Smith.

*Budget and Finance:* H. A. Dangel.

# College Notes

**Illinois Institute of Technology News Bureau.**—William A. Lewis and Fred J. Vogel have been appointed to the electrical engineering staff. Dr. Lewis, director of Cornell University's school of electrical engineering, has been named consulting electrical engineer to the Armour Research Foundation at Illinois Tech and also a research professor in the Institute's electrical engineering department, effective January 2. Mr. Vogel, who has been associated with Westinghouse Electric and Manufacturing Company for the past 24 years and who is an outstanding pioneer in the development of large power transformers, has been appointed professor of electrical engineering, effective December 1.

**Engineers' Council for Professional Development.**—Everett S. Lee, engineer, General Engineering Laboratory, General Electric Company, Schenectady, N. Y., was elected chairman at its eleventh annual meeting held recently in New York City. Also elected to serve with him are James W. Parker, vice-president and chief engineer, Detroit Edison Company, vice-chairman; Stephen L. Tyler, executive secretary, American Institute of Chemical Engineers, secretary; and R. L. Sackett, dean emeritus of engineering, The Pennsylvania State College, assistant secretary.

Committee chairmen, representing Council's four major fields of work, were named as follows: Committee on Student Selection and Guidance, A. R. Cullimore, president, Newark College of Engineering; Committee on Engineering Schools, D. B. Prentice, president, Rose Polytechnic Institute; Committee on Professional Training, John C. Arnell, assistant personnel director, Consolidated Edison Company of New York, Inc.; Committee on Professional Recognition, Chas. F. Scott, professor emeritus of electrical engineering, Yale University.

# Necrology

Professor Emeritus John Lane Van Ornum died November 6, 1943. He was born in Hartford, Vermont, May 14, 1864. He received his B.S. in Civil Engineering at the University of Wisconsin in 1888, and his Civil Engineering Degree at Wisconsin in 1891.

During six years of practical engineering Mr. Van Ornum had varied experiences in important posts, among them service as Chief Topographer for the Mexican Boundary Survey, 1891–94. In 1894 Van Ornum was appointed Instructor in Civil Engineering at Washington University, St. Louis, which post he held until 1897 when he took a year's leave for travel in Europe.

At the outbreak of the Spanish-American war Mr. Van Ornum volunteered and went, as Captain of the 3rd U. S. Volunteer Engineers, to Cuba, where his services resulted in his promotion to the rank of Major.

In 1899 he was appointed Professor of Civil Engineering and Head of the Department at Washington University, in which capacity he served continuously until his retirement in June, 1933.

Professor Van Ornum contributed freely to professional literature and his book, "Regulation of Rivers," published in 1914, received national and international attention and has long been considered an authority in that field.

Professor Van Ornum was a Fellow of the American Association for the Advancement of Science; member of the American Society of Civil Engineers; Council of national advisors, National Highways Association (life member); member of American Society of Testing Materials; International Society of Testing Materials; International Association of Navigation Congresses; Society for the Promotion of Engineering Education; American Association of University Professors; Academy of Science; Military order of Foreign Wars; New England Society of Saint Louis; (honorary member) Sigma Xi and Tau Beta Pi, and social fraternity Beta Theta Pi. Locally, he was a member of the University Club, and a past president (1903) of the Engineers' Club of St. Louis.